FORESTRY

REPORT ON THE FINAL EVALUATION OF

THE CANADA-BRITISH COLUMBIA FOREST RESOURCE DEVELOPMENT AGREEMENT 1985-1990

FOREST RESOURCE DEVELOPMENT AGREEMENT

Canada

BC

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REPORT ON THE FINAL EVALUATION OF

THE CANADA-BRITISH COLUMBIA
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AGREEMENT 1985-1990

Touche Ross

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EXECUTIVE SUMMARY

This is the executive summary of a report on the Final Evaluation of the Canada - British Columbia Forest Resource Development Agreement 1985 - 1990 (FRDA). The report was prepared by Touche Ross & Co., in association with T.M. Thomson & Associates Ltd. The study is in compliance with the requirement that the governments of Canada and British Columbia conduct a final evaluation of the Agreement.

BACKGROUND

The Agreement came into existence in May 1985 as a major regional economic development initiative designed to enhance and sustain British Columbia's forest resource base and to strengthen the employment potential of the forestry sector in the Province.

More specifically, the Agreement is to:

- manage part of the backlog of non-satisfactorily restocked (NSR) lands in the Province;
- intensively manage selected forest stands;
- support forestry research by government and non-government organizations; and,
- assist the forestry industry through studies related to utilization, marketing and product development, technology transfer and training.

The Agreement is a joint federal - provincial responsibility totalling $300 million over a five year period. Canada and the Province of British Columbia have made equal contributions to the Agreement. Each government contributed $120 million to cost-shared activities. In addition, each government contributed $30 million in direct delivery programs. The Province, in addition to its own direct delivery activities, agreed to administer and implement the Agreement's cost-shared programs. As such, the Province has the responsibility to manage and deliver $270 million of the $300 million Agreement.

Consistent with the terms of reference for the study, our evaluation consisted of three components: the overall evaluation; an economic and social impact component; and, a research and development component. The latter two components were designed to support the overall evaluation report.

Our evaluation approach involved broad-based data collection and analyses that were designed to address the specific questions raised in the terms of reference and the detailed evaluation criteria prepared during the project's Planning Phase and presented in our Evaluation Assessment Report. We conducted over 100 interviews with representatives from both levels of government, universities, industry and labour. This included a general survey of the research and development community. Our review of background documentation was extensive, and involved published and unpublished reports and discussion papers from government and industry. Finally, the evaluation included a large amount of data analyses as well as economic case study analysis focused on assessing the forestry and economic achievements and impacts of the Agreement.

OVERALL MANAGEMENT AND DELIVERY

Our evaluation indicates that the rationale and objectives of the Agreement have remained relevant and important throughout the five year time frame. Indeed, it is evident that strengthening the forestry sector through such programs as backlog reforestation, intensive forest management, and research and development can continue to make important contributions to the local, provincial and national economies in the future. At the same time, the increased knowledge and experience acquired over the past five years, combined with changing forestry, economic, social and environmental conditions, create additional demands and priorities for the future.

Our examination revealed that the efforts of the two governments have been complementary and mutually supportive. These efforts have been consistent with the goals of the Agreement and with the strategic intent of the Forest Sector Strategy for Canada and, more recently, the National Forest Sector Strategy for Canada.

Overall, there is an apparent wide-spread belief among representatives from the two levels of government, the academic community, industry and labour that the Agreement has been implemented effectively, in compliance with the conditions and intent of the Agreement, and in accordance with principles of forestry management normally applied

by the Ministry of Forests. Our evaluation supports this belief, and confirms that the objectives of the Agreement have been satisfied.

FORESTRY MANAGEMENT

The Agreement has met or surpassed most of its objectives with respect to backlog reforestation, intensive forest management and contribution to long-run wood supply.

With respect to backlog reforestation, the Agreement has supported the planting of an estimated 138,400 hectares (ha), representing roughly 163 million seedlings. Both of these levels were essentially equal to planned levels. These activities, combined with reclassification of NSR lands through field surveying, supported by the Agreement, have resulted in a reduction of the backlog by approximately 35 percent.

The Agreement supported a number of silvicultural activities. In almost all cases, the actual levels of silvicultural treatments provided were at the intended levels. Our evaluation indicates that most of these activities were performed within original or revised budget levels.

Together, the backlog reforestation and intensive forest management activities are likely to result in an addition of 555,600 m^3 to the annual long-run sustainable yield of the Province, once the results of FRDA related activities are incorporated into future timber supply analysis by the Ministry of Forests. This represents an achievement of 93 percent of the planned level of 600,000 m^3.

It was apparent from our review that FRDA-funded silviculture projects were implemented in compliance with the environmental provisions of the Agreement. These projects were delivered in a manner that satisfied most existing Ministry of Forests and Ministry of Environment policies and procedures. As a result, they generally have been subjected to the environmental review processes of the Province. It was also evident, however, that FRDA projects placed significantly increased demands on the environmental review resources of the Province.

ECONOMIC IMPACTS

Our analysis indicates that the Agreement likely will surpass its economic goals. The positive forestry results that have been achieved translate into significant potential economic benefits at the local, provincial and national levels.

Once the potential incremental long run sustained yield has been included into the timber supply analysis and begins to be processed, permanent employment in British Columbia resulting from the Agreement is estimated at 1,044 jobs, more than double the expected level of 500. In addition, it is estimated that 406 permanent jobs will be created in other provinces. Direct and indirect short-term employment created in the Province amount to 31,137 jobs. This is more than double the planned level.

When the potential incremental yield is accounted for in the timber supply analysis and begins to be processed, the economic benefits are substantial. This includes an additional $61.7 million annually to gross domestic product in the Province, with a further $20.0 million annually to the rest of Canada. Also, it is evident that a significant silviculture industry has emerged in the Province to support the Agreement. This industry now numbers approximately 700 firms, many of which are highly dependent on FRDA projects. These positive economic benefits have been experienced in all forest regions of the Province, and have contributed to the long-term stability of several communities.

RESEARCH AND DEVELOPMENT

The Extension, Demonstration and Research and Development (R&D) components of the Agreement have made a positive contribution to the forestry-research community in the Province. The R&D component has proved to be a much needed boost to both the spirit and level of activity in forest management research in British Columbia. In addition, it is evident that the research achievements that have been made should lead to the ongoing application of improved silviculture practices throughout the Province. Similarly, our evaluation identified opportunities for improvements in the delivery of these components for the current and any future agreement.

In general, the knowledge acquired from the research and development activities that have been performed has not yet been fully and effectively transferred to forestry practitioners in government and industry as planned under the Agreement. Our peer review panel expressed concerns about the limited degree of innovation reflected in the research studies undertaken. This concern was highlighted by the sample of research studies they reviewed in detail. They felt research opportunities may have been constrained by the term of the Agreement. The panel felt that more research was needed to address opportunities for improving the performance of the forestry sector by minimizing the costs of forestry management and identifying opportunities for improving the value-added performance of the forestry sector.

ISSUES TO BE ADDRESSED IN A FUTURE AGREEMENT

A central focus of our evaluation was to develop recommendations that will assist in shaping the structure, funding, duration, implementation and management of any future forest development agreement. In this respect, our evaluation report presents twenty-four recommendations developed specifically to address issues concerning a future agreement.

A future agreement should continue to place a heavy emphasis on backlog reforestation, intensive forest management and support for research and development. This reflects the considerable achievements already accomplished and the work that remains to be done in restocking the Provincial forests and sustaining the long-term performance of the forest sector, particularly in forestry-dependent communities.

At the same time, it is clear that new issues and priorities are emerging, which may impact the focus of a new agreement. These include issues such as: the need for increased manufacturing of value-added products in the sector; the long-term employment potential of the industry in the face of increased use of technology; the continuing uncertainty facing many forestry-dependent communities; concerns for increasing the wood quality and species diversification to meet new market demands; and, growing sensitivities about the environmental impacts of intensive silviculture practices. The emphasis to be placed on these and other important issues, relative to the priorities of a future agreement, must be established.

In our view, a significant area of concern relates to the general management orientation underlying an agreement of this nature. While we recognize that economic performance cannot be evaluated accurately without reasonable rotation length predictions of growth and yield, our evaluation indicates that the systems and processes that were established to support the management of such an agreement lacked an orientation toward the optimization of economic returns from silviculture investments. As a result, although the current Agreement achieved most of its intended goals, using Ministry of Forests procedures and data provided by FRDA activities for growth and yield, a future agreement should be concerned that economic benefits are considered and maximized.

We believe that there are a number of enhancements that can be made to the systems and processes supporting a future agreement. These enhancements would serve to promote an increased orientation towards optimization of economic returns from alternative silviculture investments. In future, systems and processes to monitor and assess the potential economic benefits to regional economies resulting from forest resource activities and expenditures should be developed and implemented.

To assist industry through improvements in utilization, marketing, product development and knowledge transfer, research and development funds supporting the development of methods for improving the long-term performance of the forestry sector by maximizing net economic returns from silviculture investments or identifying opportunities for increased value-added in the sector are important considerations for a future agreement.

It is evident that long-term benefits from the current Agreement are only likely to be realized if the areas treated under FRDA are managed in accordance with principles of sound forestry management. Any future agreement should have as a high priority, the continued treatment of FRDA lands, as appropriate. In this respect, it will be important that any new agreement be developed within the context of an overall strategic direction that addresses British Columbia forestry management and economic development issues and priorities over the long-term.

In order to continue to assist the forest industry, it will be important to ensure that a new agreement promotes the participation of industry in the planning, implementation and evaluation of activities and achievements. This should include operational participation in the advisory and working group structures established to support the overall management of an agreement.

Environmental assessment and protection should be important elements of a new agreement. This includes ensuring that appropriate policies and processes are in place to support effective planning, implementation and evaluation of the environmental impacts of agreement-funded silviculture activities at the provincial and regional levels. In designing these mechanisms, it will be important to ensure that they are consistent with the concept and principles of integrated resource management and planning, and that administrative resource implications are identified and addressed.

Research and development should continue to be an important part of any prospective agreement. Research should address issues related to promoting and improving the long-term performance of the forestry industry through the maximization of economic returns from silviculture investments and the identification of opportunities for improved utilization, marketing and product development. Similarly, it will be important to ensure that a heavy emphasis is placed on technology transfer and training through extension and demonstration activities. A future agreement should be more specific about what is expected from the research component in terms of a well-developed research strategy with clearly identified deliverable products and research time frames.

Finally, it will of course be important to ensure that any future cooperative arrangement is supported by adequate levels of human resources within the British Columbia Ministry of Forests and Forestry Canada. These levels should be adequate to ensure that the objectives can be fully satisfied, while maintaining due regard for value-for-money.

I. INTRODUCTION

A. BACKGROUND

This is the report for the Final Evaluation of the Canada - British Columbia Forest Resource Development Agreement 1985 -1990 (FRDA). The report was prepared by Touche Ross & Co., in association with T.M. Thomson & Associates Ltd. The study is in compliance with the requirement that Canada and the Province of British Columbia jointly effect an assessment of the programs listed in Schedule "A" of the Agreement, during the term of the FRDA and no later than September 30, 1989. The report represents completion of the final evaluation study.

B. OBJECTIVES AND SCOPE OF THE FINAL EVALUATION

Objectives

The objectives of the final evaluation of the Agreement are to:

- evaluate the overall effectiveness of the Agreement in meeting its objectives;
- assess the employment and overall economic and social impact of the backlog reforestation and intensive forest management programs on a regional basis;
- determine the contribution to the long-term wood supply of the Province resulting from the silviculture activities;
- assess the research and development programs with respect to the quality of research, applicability of results and the economic impact; and,
- provide recommendations that would assist in shaping the structure, funding, duration, implementation and management of any such agreement in the future.

Scope

The evaluation study had three principal components:

- an overall evaluation of the Agreement;
- an economic and social impact component; and,
- a research and development component.

The latter two components were designed to support the findings and recommendations to be presented in the overall evaluation report. Specific evaluation questions to be answered by each component were presented in the terms of reference.

One of the key considerations with respect to the study scope was that the Agreement was still in force during the conduct of the final evaluation. Therefore, financial and performance data did not exist for the full term of the Agreement. As a result, the evaluation incorporates available actual data for the period covering the first four years to March 31, 1989, and, based on plans and commitments approved by the Management Committee, extrapolates the final year activities, expenditures and achievements. This allowed a reasonable basis for assessing the achievements over the full five year term.

A further scope consideration was that information was collected and interviews conducted largely at the headquarters and regional levels, although selected district personnel were contacted. Also, since the FRDA planning and reporting framework is structured on six forest regions (Cariboo, Kamloops, Nelson, Prince George, Prince Rupert and Vancouver), we respected this categorization in conducting our evaluation.

Finally, the overall scope of the study was defined by the evaluation framework that was developed during the Planning Phase. This framework identified the evaluation criteria and sub-criteria to be examined during the study.

C. EVALUATION APPROACH

Our approach for the final evaluation was designed to ensure that the study addressed the objectives and scope presented in the terms of reference and refined further in the Evaluation Assessment Report prepared during the project's Planning Phase. The key components of our approach are presented below.

Broad-Based Data Collection and Analyses

The magnitude and complexity of this Agreement demanded an evaluation approach consisting of broad-based data collection, analyses and modelling. Rather than examine numerous individual transactions or projects, our evaluation strategy was focused at a level that provided insight into issues concerning the overall management and results of the Agreement. This required a data collection and analysis methodology that was designed to address broad issues (ie. program delivery and implementation). At the same time, we substantiated our overall findings with evidence based on selected transactions or projects. This approach enabled the evaluation to focus on an assessment of the key activities and mechanisms used to manage the Agreement, and the extent to which these promoted the achievement of the stated objectives and goals.

A key element of our data collection was personal and telephone interviews with a wide range of management and implementation staff, as well as program clients. In total, over 100 interviews were conducted with representatives from both levels of government, universities, industry and labour. This included a general survey of operational foresters who are probable users of the research findings. These interviews were used to obtain both detailed information on the management and results of the Agreement, as well as views and concerns regarding the Agreement's overall effectiveness.

In addition to interview-based information, the evaluation involved collecting and analyzing documented information on program delivery, forestry management impacts, economic impacts, and research achievements. This included collection and review of: performance and financial information; available studies and reports commissioned and conducted throughout the term of the Agreement by the Management Committee and relevant to the evaluation components; and, extensive data analyses.

We reviewed previous evaluations of FRDA activities, including the Mid-Term Evaluation (July 1988), the Review of the Indian Lands Program (April 1988) and the findings and recommendations of the Auditor General of Canada's 1988 examination of the Canadian Forestry Service. We also considered the draft findings of an overall evaluation of the Forestry Development Program, commissioned by Agriculture Canada. Again, all of this background information was collected and analyzed at a level that supported the development of conclusions on the overall management and results of the Agreement.

We undertook extensive data analyses focusing on the demonstrated forestry management and economic impacts of the Agreement. Our analysis was conducted using Ministry of Forests and FRDA data including growth and yield information, and involved the application of this data to accepted standards, norms and assumptions used by government, universities and industry to estimate the current and future impacts of forestry expenditures and activities. Our analysis was conducted at regional and provincial levels and included analyses by treatment, species and site class. Also, we conducted microeconomic case studies of selected FRDA expenditures. The results of our analyses were consolidated to provide indications of the overall results of FRDA.

Consolidation and Integration of Findings

Given that the evaluation was organized into three principal components, a key element of our overall strategy was a heavy emphasis on ensuring that the findings from each component were effectively consolidated and integrated in a manner that fully satisfied the evaluation objectives. Each component of the final evaluation had as its principal focus those evaluation questions and criteria directly relevant to its domain. At the same time, each component was required to address the full range of evaluation criteria to be examined by the overall study.

By adopting this strategy, the evaluation provided detailed findings with respect to the specific areas of concern (e.g. increase in forest resources, strengthening of employment, and promoting forestry research and development). In addition, the study supported the development of broader conclusions on the overall management and delivery of the Agreement.

Consolidation and integration of findings were achieved by frequent communication between members of the project teams of each component and joint-review of evaluation findings, conclusions and recommendations.

Objective and Constructive Assessment

During the Assessment Phase, project team members from each evaluation component prepared their respective assessments, taking into account both their detailed findings and the knowledge acquired through the review and consolidation of overall findings. In addition, each evaluation component project team was required to develop recommendations pertaining to both their individual areas and the overall evaluation.

A central feature of the evaluation strategy and methodology was a strong orientation toward objective and constructive analysis. The intent of our evaluation was to develop sound, practical conclusions and recommendations that could be used to improve any future programs of this nature.

Although the consultants maintained objectivity and balance in their evaluation work, the objectivity of the evaluation was further enhanced by the use of independent panels of experts to review and challenge our evaluation findings, conclusions and recommendations. Two panels were used:

- a Peer Review Panel to evaluate research and development achievements; and,
- a Challenge Panel to review the overall evaluation conclusions and recommendations.

Use of these panels resulted in an objective and constructive focus in the development of our final conclusions and recommendations.

AREAS OF EVALUATION

I. MANAGEMENT AND DELIVERY OF THE AGREEMENT

- Rationale and Objectives
- Strategy, Resources and Time Frame
- Management Structures and Administrative Practices
- Information Management and Communication
- Program Delivery and Implementation

II. FORESTRY MANAGEMENT

- Silviculture Activities
- Wood Supply
- Environmental Impacts

III. ECONOMIC IMPACTS

- Employment and General Economic Performance
- Forestry-Dependent Communities

IV. EXTENSION, DEMONSTRATION AND RESEARCH AND DEVELOPMENT

- Management and Administration
- Peer Review and User Survey

Formal Evaluation Framework

Prior to conducting our detailed evaluation, we developed a formal evaluation framework that was designed to ensure that the evaluation objectives and questions presented in the terms of reference were appropriately addressed. The framework, presented in our Evaluation Assessment Report, consisted of nine principal evaluation criteria that build on the specific objectives and questions presented in the terms of reference. Each evaluation criterion was supported by a number of more specific sub-criteria that established in detail the focus and parameters for the broader criterion. Our approach was to assess the extent to which the management and results of the Agreement have been appropriate, relative to each of our areas of evaluation.

D. REPORT STRUCTURE

The next section of this report, Section II, presents an overview of the forestry sector and a general discussion of the Agreement. In Section III, we present our overall assessment of the Agreement together with a summary of all our recommendations.

We present a detailed discussion of our principal evaluation findings, conclusions and recommendations in Section IV. The sub-sections within Section IV derive from the major areas of our evaluation: management and delivery of the Agreement; forestry management; economic impacts; and, extension, demonstration and research and development. The specific areas discussed within each sub-section are presented opposite this page. Each of these areas contains a discussion of our findings and conclusions and, as appropriate, our recommendations (highlighted in **bold**).

The appendices to the report provide further discussion of our approach and findings related to forestry management and economic impacts.

II. OVERVIEW OF THE FORESTRY SECTOR AND THE AGREEMENT

A. THE FORESTRY SECTOR

The forestry sector has traditionally been a major contributor to the economies of Canada and British Columbia. A large part of the Canadian and Provincial economies were founded on forestry and the sector continues to make significant contributions to employment, gross domestic product, exports, government revenues, and other important elements of these economies.

At the national level, an estimated 286,000 jobs were directly dependent on the forestry sector in 1987; a further 596,000 jobs were indirectly dependent on the sector. In the same year, the total value of Canadian forest shipments was estimated at $36.2 billion. In addition, Canada continually ranks among the world leaders in exports of manufactured forest products. In 1988, exported forest products were valued at $22.5 billion. The vast majority of forestry exports contribute a positive trade balance to the economy.

British Columbia has the largest forestry sector among Canadian provinces accounting for 61 percent of the total Canadian lumber production (softwood and hardwood) in 1988. The Province harvests approximately 70 - 80 million m^3 annually, roughly twice the level produced by the second ranked province (Quebec). Approximately one-quarter of the direct employment in the industry is located in British Columbia.

Given the contribution of British Columbia to the national forestry sector, it follows that forestry is a major part of the Provincial economy. In fact, forestry is British Columbia's largest industrial sector, accounting for approximately 50 percent of the manufacturing shipments of the Province. Approximately one-fifth of the provincial labour force is employed directly or indirectly by the forestry sector. In addition, there are some 126 communities in the Province that have been classified as economically-dependent on the forestry sector.

OBJECTIVES OF THE AGREEMENT

The overall objective of the Agreement is to:

- manage the forest resource of the Province, in order to sustain and increase the long-term supply of wood and thereby strengthen the employment potential of the forest industry.

More specifically, FRDA is to:

- manage part of the backlog of non-satisfactorily restocked (NSR) lands in the Province;
- intensively manage selected forest stands;
- support forestry research by government and non-government organizations; and,
- assist the forest industry through studies related to utilization, marketing and product development, technology transfer and training.

As with most resource-based industries, the forestry sector is faced with increasing challenges. This includes the need to balance long-term supply and demand, while managing a resource that is becoming less abundant. Added to this are growing concerns about the ability of the sector to safeguard the environment while continuing to sustain high levels of production.

Given the significance of the sector to the national and provincial economies, it is not surprising that the two levels of government have for many years recognized that the health and performance of the forestry sector is a major factor in economic growth and stability.

B. THE CANADA - BRITISH COLUMBIA FOREST RESOURCE DEVELOPMENT AGREEMENT

FRDA is a subsidiary agreement under the umbrella Economic and Regional Development Agreement (ERDA) signed by the Government of Canada and the Province of British Columbia in November 1984. It is the second general forestry agreement between Canada and British Columbia. The FRDA concept was developed in the early 1980's and was the result of a discussion paper entitled A Forest Sector Strategy for Canada, September 1981, and a policy statement entitled A Framework for Forest Renewal, September 1982. These documents provide the overall context for the current Agreement. The objectives of the Agreement are presented opposite. In addition to these overall objectives, Schedule A of the Agreement sets out more specific program achievement goals.

At the beginning of the Agreement, it was widely accepted that the long-term market trends for the British Columbia forest industry would be strong, with major increases in demand likely to occur. Also, the industry appeared to be facing significant supply constraints in terms of the quality and quantity of timber available for harvest. The constraint was not in the form of an immediate lack of commercial wood, but rather, in the form of a projected fall-down of commercial wood supply as old-growth stands are depleted and replaced with lower per unit volume second-growth stands.

These projected resource constraints seriously threatened the long-term stability and potential of the industry. The Agreement was seen as a major step toward renewing and improving the forest resource, and maintaining the annual rate of harvest at levels above those previously supported by forestry management programs.

The current five year Agreement came into existence in May 1985 to enhance and sustain British Columbia's forest resource base and to strengthen the employment potential of the forest industry. The Agreement is a joint federal - provincial responsibility totalling $300 million and represents one of the largest regional economic development agreements of its type. Canada and the Province of British Columbia have made equal and significant financial contributions to the Agreement. Each government agreed to contribute $120 million to cost-shared activities. In addition, each government contributed $30 million in direct delivery programs.

Through a Management Committee, the two governments are jointly and directly involved in administering and monitoring fourteen sub-programs within the three principal program thrusts of the Agreement (Backlog Reforestation; Intensive Forest Management; and, Implementation, Communications and Evaluation). The Province, in addition to its own direct delivery activities, agreed to administer and implement the Agreement's cost-shared activities. As such, the Province has the responsibility for planning, coordinating, implementing, monitoring and reporting activities representing $270 million of the total planned expenditures of $300 million.

III. OVERALL ASSESSMENT AND SUMMARY OF RECOMMENDATIONS

A. OVERALL ASSESSMENT

The Canada - British Columbia Forest Resource Development Agreement 1985 - 1990 was established as a major regional economic development initiative, designed to address forecasted shortages of wood supply and conditions of severe unemployment in the important British Columbia forestry sector. The Agreement specifically focused on backlog reforestation and intensive forest management as a means to address both current and long-term economic concerns. It also contained components to support forestry-related research and development projects, including extension and demonstration activities. These initiatives were aimed at improving the overall performance of the forestry sector.

Our evaluation indicates that the rationale and objectives of the Agreement were appropriate to the forestry and economic conditions facing the Province in the mid 1980's. The Agreement was designed only to begin the process of reducing the backlog of non-satisfactorily restocked forest lands. Indeed, concerns related to wood supply and economic stability continue today and a significant backlog still exists. Many communities continue to be economically dependent on the forest industry, although employment conditions, have improved significantly since 1985. In addition, the long-term potential of the forestry sector to sustain the Provincial and local economies continues to be questioned, given the increasing automation in industry practices and history of limited levels of value-added manufacturing in the sector.

Notwithstanding these continuing concerns, the Agreement has achieved its intended results with respect to backlog reforestation, silviculture activities, contribution to incremental wood supply, and employment generation.

With respect to backlog reforestation, the Agreement has supported the planting of 138,400 ha with 163 million seedlings. Both of these achievements are essentially at planned levels. These activities, combined with some reclassification of NSR lands through field surveys supported by the Agreement, have resulted in a reduction of the backlog by approximately 35 percent. The estimated remaining backlog is in the order of 483,700 ha, indicating that a substantial level of reforestation remains to be done.

The Agreement supported a number of silviculture activities. In almost all cases, the actual levels of silvicultural treatments provided were at the intended levels. In addition, our evaluation indicates that most activities were performed within original or revised budgets.

Assuming the results of FRDA related activities are incorporated into future timber supply analysis by the Ministry of Forests, the backlog reforestation and intensive forest management activities are likely to result in an addition of 555,600 m^3 to the annual long-run sustainable yield of the Province. Details of this analysis are presented in Appendix A. This represents an achievement of approximately 93 percent of the planned level of 600,000 m^3.

When these timber supply contributions are incorporated into the allowable harvest and being harvested, the Agreement will surpass its goals in terms of economic contributions. Permanent employment in British Columbia resulting from the Agreement is estimated at 1,044 jobs, more than double the expected level. In addition, it is estimated that 406 permanent jobs will be generated in other provinces, bringing the total number of permanent jobs created to an estimated level of 1,450. Direct and indirect short-term employment created in the Province amount to 31,137 jobs, more than double the planned level. In total, the economic contributions of FRDA can amount to an additional $61.7 million annually to gross domestic product (GDP) in the Province, with a further $20.0 million annually to the rest of Canada.

Our assessment of the research and development components of the Agreement indicates that they have contributed favourably to a growing forestry research community in the Province. Although it is premature to assess the ultimate contributions of research findings supported by the Agreement, it is likely that those projects will enhance the silviculture practices and overall performance of the forestry sector. We did, however, identify some opportunities for improvement with the research and development components of the Agreement. In general, the knowledge acquired from these activities has not yet been fully and effectively transferred to forestry practitioners. Our peer review panel expressed concerns about the limited degree of innovation reflected in the research studies undertaken. This concern was highlighted by the sample of research studies they reviewed in detail. They felt research opportunities may have been constrained by the term of the Agreement. A well developed integrated research strategy with clearly identified deliverable products and research time frames that had direct relevance to FRDA objectives would have been useful. The absence of a good understanding of the backlog NSR situation in the Province at the outset of the

It was apparent from our review that FRDA-funded silviculture projects were implemented in compliance with the environmental provisions of the Agreement. These projects were delivered in a manner that satisfied most existing Ministry of Forests and Ministry of Environment policies and procedures. As such, they have generally been subjected to the environmental review processes of the Province. It was also evident that FRDA projects placed significantly increased demands on the environmental review resources of the Province.

Our evaluation identified some important limitations with respect to the general management orientation underlying an agreement of this nature. In our view, and acknowledging that economic performance cannot be evaluated accurately without reasonable rotation length predictions of growth and yield, the systems and processes that were established to support the management of such an agreement lacked an orientation toward the optimization of economic returns from silviculture investments. As a result, although the current Agreement achieved most of its intended goals, using Ministry of Forests procedures and data provided by FRDA activities for growth and yield, a future agreement should be concerned that economic benefits are considered and maximized.

Our specific concerns with respect to the overall orientation of the Agreement suggest that a number of enhancements should be considered to the systems and procedures supporting a future agreement. In future, systems and processes to monitor and assess the potential economic benefits to regional economies resulting from forest resource activities and expenditures should be developed and implemented.

To assist industry through improvements in utilization, marketing, product development and knowledge transfer, research and development funds supporting the development of methods for improving the long-term performance of the forestry sector by maximizing net economic returns from silviculture investments and identifying opportunities for increased value-added in the sector are important considerations for a future agreement.

B. SUMMARY OF RECOMMENDATIONS

MANAGEMENT AND DELIVERY OF THE AGREEMENT

1. A future forestry resource development agreement should build on the achievements that have been made under the current Agreement by continuing to focus on backlog reforestation, intensive forest management, and research and development. At the same time, it will be important to address the significant changes in Provincial forestry, economic, social and environmental conditions that have emerged through harmonizing the thrusts of any future agreement within the context of a clearly defined forestry resource management strategy for the Province.

2. A future forest resource development agreement should be developed within the context of a formal, long-term (20 years or more) strategic forest resource management direction for the British Columbia forestry sector which establishes clear priorities for the forestry sector, within the framework of broad economic, social and environmental considerations.

3. A new agreement should be supported by formal, comprehensive and appropriately funded, strategic and operational planning processes and should incorporate mechanisms for determining economic returns and achievements likely to result from planned expenditures on sites, treatments and species, as well as forestry and economic criteria for establishing priorities within regions and districts.

4. The British Columbia Ministry of Forests and Forestry Canada should ensure that adequate levels of human resources are available to support fully the management and delivery expectations of a future agreement.

5. A future forestry agreement should be directed by a joint federal-provincial management committee, which is clearly accountable for directing all cost-shared programs and for coordinating the cost-shared and direct delivery program activities.

6. A future agreement should be supported by an advisory committee representing the views of key interest groups in the Province (e.g. industry, labour, environment) and that participates and provides input to the decision making processes.

7. A future forest resource development agreement should include a requirement for the development and use of appropriate and coordinated operational use methodologies, processes and systems to predict, monitor and report annually on estimated rotation length growth and yield achievements of alternative silvicultural regimes.

8. In order to ensure that the objectives, activities and achievements of a future agreement are communicated effectively and clearly to interested parties, including the general public, external communications should be an important element of any future agreement and should be supported by funding appropriate to the size of the total agreement value.

9. Private and Indian Land programs should be included in a future agreement and together with other direct delivery programs should be supported by formal planning and monitoring processes, appropriate administrative policies, and should be coordinated fully with cost-shared programs.

FORESTRY MANAGEMENT

10. A future agreement should make provisions for the continued management of lands that received silviculture treatments under the current Agreement and a monitoring system of annual technical audits based on criteria developed from sound forest management principles, including yield and economic impacts, should be included.

11. Significant silviculture investments made under a future agreement should be supported by appropriate financial and economic cost-benefit analysis within an established and consistent analytical framework.

12. **A future forestry agreement should have as a priority the continuation of programs aimed at reducing the backlog NSR, on economically viable sites, focused at specific regional yield goals.**

13. **A future agreement should include the requirement to develop and document a formal methodology for estimating rotation length growth and yield impacts resulting from the silviculture activities to be supported by an agreement and should be appropriate to support economic analysis of expenditures made under an agreement.**

14. **Defining what "better" wood quality really means and assessing the impact of silviculture practices on wood quality, and the resulting affects on the value of wood produced, should be an important consideration of a future agreement.**

15. **A future agreement should provide sufficient funding to implement a comprehensive environmental assessment function which involves a process of environmental resource planning and monitoring at the Provincial and regional levels and should be conducted from an integrated resource management perspective that takes into account natural resource and habitat conditions while effectively supporting silviculture practices.**

ECONOMIC IMPACTS

16. **A future agreement should develop employment standards and be supported by systems and processes that measure and provide sound indications of the planned and actual net economic benefits resulting from forestry investments and should be developed as an integral part of an explicit wood supply strategy for each forestry region of the Province.**

17. **A future agreement should continue to place a high priority on regional economic development and, more specifically, it should support the needs of forestry-dependent communities as expressed in regional timber supply forecasts.**

18. A future agreement should be supported by systems and processes to promote the achievement of regional economic development objectives and this should include regional investment planning that integrates planned silviculture activities and expenditures with regional timber supply simulations.

EXTENSION, DEMONSTRATION AND RESEARCH AND DEVELOPMENT

19. The R&D activities have made and will continue to make positive contributions to the forestry sector and should continue as an important priority of a future agreement.

20. The R&D activities of a future agreement should be supported by advisory committees with clear functions and strategic directions, formal operating policies, clear terms of reference, and documented common decision-making criteria.

21. A future agreement should be much more specific about what is expected from the research component in terms of a well developed integrated research strategy with clearly identified deliverable products and research timeframes.

22. The R&D component of a future agreement should encourage and promote research into the development of methods for reducing the costs of specific wood supply targets and for estimating the economic and financial returns of forestry investments.

23. The R&D component of a future agreement should support innovative research into methods of improving the performance of the forestry sector relative to product development, marketing and increased value-added manufacturing.

24. A future agreement should place even greater emphasis on the need to communicate research findings through extension and demonstration activities in order to facilitate the operational application of the results.

VI. PRINCIPAL EVALUATION FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

In this section we present our principal evaluation findings, conclusions and recommendations. These have been organized into four main groups:

- Management and Delivery of the Agreement;
- Forestry Management;
- Economic Impacts; and,
- Extension, Demonstration and Research and Development.

These four categories represent the major areas of our evaluation. For each of these areas we present a detailed discussion of our findings and conclusions and, as appropriate, provide recommendations for improving a future agreement between the two governments.

A. MANAGEMENT AND DELIVERY OF THE AGREEMENT

A major element of our evaluation involved a review of the overall management and delivery of the Agreement. In conducting this review, we focused on five key aspects of management and delivery:

- rationale and objectives;
- strategy, resources and time frame;
- management structures and administrative practices;
- information management and communications; and,
- program delivery and implementation.

Our findings, conclusions and recommendations with respect to each of the above are discussed in the following sub-sections.

A.1. Rationale and Objectives

Findings and Conclusions

Our evaluation indicated that the rationale and objectives of the Agreement were relevant and remained important throughout the five year time frame. The Agreement, though not intended as a substitute for a forest resource management strategy in British Columbia, addressed an important need to reduce the backlog of non-satisfactorily restocked (NSR) lands as well as to improve forest management and generate employment through intensive silviculture activities. In addition, the extension, demonstration and research and development components of the Agreement addressed a legitimate concern with improving the overall efficiency and performance of the forest sector.

It was apparent from our evaluation that the provincial and federal governments worked effectively together in their efforts to achieve the general and specific objectives and goals of the Agreement. The efforts of the two governments have been complementary and mutually supportive, and have been consistent with the overall intent of the Forest Sector Strategy for Canada and, more recently, the National Forest Sector Strategy for Canada.

It is evident, however, that despite the positive efforts of the Agreement to manage part of the backlog NSR, a significant level of backlog NSR continues to exist. As discussed later in this report, we estimate that the backlog NSR will be reduced by approximately 35 percent, over the term of the Agreement. Much of the reduction in backlog can be attributed to the activities performed under the Agreement, as well as measures introduced by the Province to ensure that the backlog does not continue to grow.

It is clear that given the backlog that remains and the continuing concerns that exist with respect to forest management, the major thrusts of the Agreement (backlog reforestation, intensive forest management, and research and development) will continue to be relevant to the forest sector and the provincial and national economies. At the same time, the increased knowledge and experience acquired over the past five years, combined with changing forestry, economic, social and environmental conditions, create additional demands and priorities for the future.

Recommendation

1. **A future forestry resource development agreement should build on the achievements that have been made under the current Agreement by continuing to focus on backlog reforestation, intensive forest management, and research and development. At the same time, it will be important to address the significant changes in Provincial forestry, economic, social and environmental conditions that have emerged through harmonizing the thrusts of any future agreement within the context of a clearly defined forestry resource management strategy for the Province.**

A.2. Strategy, Resources and Time Frame

Findings and Conclusions

Our evaluation indicated that the strategic direction for the Agreement was communicated adequately and understood by most participants involved in its management and delivery. The overall thrusts of FRDA are expressed in the Agreement document, the Forest Sector Strategy for Canada, and the subsequent National Forest Sector Strategy for Canada. These documents provide an overall policy framework to support priority setting and decision making.

To support the operational activities performed under the Agreement, the British Columbia Ministry of Forests, Silviculture Branch relied on its existing annual planning and budgeting process. These annual plans were prepared within a five year planning framework. This planning is a bottom-up process involving participation of districts, regions and the Branch. During our evaluation, Ministry of Forests personnel at all levels expressed satisfaction with this planning and budgeting process.

Our evaluation indicated that improvements can be made to strategic and operational planning processes in the future. The planning activities that were undertaken for backlog reforestation did not support fully the targeting of expenditures based on expected results, or an assessment of the economic viability of projects. In addition, the Ministry of Forests Timber Supply Area (TSA) steering committees were not involved significantly in the establishment of regional priorities for FRDA, or an analysis of the likely impacts of FRDA activities on regional timber supply areas. Had these factors been considered, especially during the early stages of the Agreement, increased value-for-money in program expenditures and activities may have resulted. As an example, NSR sites could have been assessed and priorized with respect to anticipated economic costs and benefits before receiving funding.

FINANCIAL SUMMARY
($ MILLIONS)

	DIRECT DELIVERY PROGRAMS				COST-SHARED PROGRAMS		TOTAL		FORECAST OVER/UNDER
	FEDERAL		PROVINCIAL						
	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	
1.0 BACKLOG REFORESTATION									
1.1 SURVEYS & PRESCRIPTIONS	2.4	0.5			12.2	3.0	14.6	3.5	11.1
1.2 SEEDS AND SEEDLINGS	0.4	2.0	19.6	21.0	31.1	42.6	51.1	65.6	(14.5)
1.3 SITE PREP & REHABILITATION	1.0	4.0			44.8	53.2	45.8	57.2	(11.4)
1.4 PLANTING	0.3	3.0			54.5	41.2	54.8	44.2	10.6
1.5 IMPLEMENTATION	3.6	5.0					3.6	5.0	(1.4)
1.6 EXT.,DEMO & R&D	3.9	4.0	7.3	6.0	14.8	14.0	26.0	24.0	2.0
PROGRAM TOTALS	11.6	18.5	26.9	27.0	157.4	154.0	195.9	199.5	(3.6)
2.0 INTENSIVE FOREST MANAGEMENT									
2.1 BRUSHING & WEEDING	0.3	2.0	1.0	1.0	11.0	8.0	12.3	11.0	1.3
2.2 CONIFER RELEASE	0.2	1.0			3.8	4.0	4.0	5.0	(1.0)
2.3a JUVENILE SPACING	1.8	4.5			34.6	40.0	36.4	44.5	(8.1)
2.3b ALLOCATION TO TFL's					5.5		5.5		5.5
2.4 FERTILIZATION	0.2	0.5			9.6	20.0	9.8	20.5	(10.7)
2.5 IMPLEMENTATION	2.1	2.0					2.1	2.0	0.1
2.6 EXT., DEMO & R&D	1.0	1.0	2.0	2.0	—	—	3.0	3.0	-
PROGRAM TOTALS	5.6	11.0	3.0	3.0	64.5	72.0	73.1	86.0	(12.9)
3.0 IMPLEMENTATION, COMMUNICATIONS AND EVALUATION									
3.1 IMPLEMENTATION & EVAL.	0.2	0.5	0.1		13.1	12.0	13.4	12.5	0.9
3.2 COMMUNICATIONS	0.1	—	—	—	1.9	2.0	2.0	2.0	-
PROGRAM TOTALS	0.3	0.5	0.1	—	15.0	14.0	15.4	14.5	0.9
UNALLOCATED FUNDING	10.9						10.9		10.9
TOTAL - ALL PROGRAMS	28.4	30.0	30.0	30.0	236.9	240.0	295.3	300.0	(4.7)

- Includes actual expenditures for 1985/86 - 1988/89, and budgets for 1989/90.
- The Federal direct delivery component has not allocated the budgets for year 5 and the two remaining payout years into specific activities.
- Both the Federal and Provincial direct delivery components include in the budget columns expenditures in the payout years following 1990 - Federal: 1990/91 - $2.1; 1991/92 - $0.2; Provincial: 1990/91 - $3.2
- Source: British Columbia Ministry of Forests and Forestry Canada

As it was, the allocation of funding for backlog reforestation to districts and regions was based on their proportion of the total medium and good NSR land in the Province, as indicated in a 1980 provincial report. However, an analysis of the economic returns likely to result from different expenditure patterns (e.g. variations in sites, treatments or species) was not included as part of the decision-making process.

In order to ensure that funds for intensive forest management were allocated efficiently to all regions, the Ministry of Forests developed Intensive Allocation Criteria (IAC) to assist in the analysis and priorization of regional conditions and needs. In total, 16 criteria were developed to address issues related to timber supply, regional goals, forestry dependency, and natural endowment. Our evaluation indicated that this process for regional allocation of intensive forest management resources was generally appropriate. In future, the process could be improved by the introduction and application of criteria to support the priorization of individual projects within districts.

The level and allocation of funding to the three major programs and fourteen sub-programs of the Agreement is presented in Exhibit 1, opposite.

As indicated in the Exhibit, expenditures generally have been consistent with the intent of the Agreement. It is expected that almost all of the $300 million will be expended by the end of the two years beyond 1990 when payments for committed expenditures as of March 31, 1990 can be made. Variances in expenditures resulted from minor administrative shifts, favourable and unfavourable variances in the unit costs for activities, and unfavourable weather conditions in some periods.

The mid-term evaluation report identified some shifting of funds between programs without formal ministerial approval, particularly with respect to surveys and prescriptions, and planting. Some adjustments to budgets have been undertaken to reconcile the funding shifts and, as required, formal ministerial approval for these shifts was obtained in November, 1989.

With respect to the human resources that were available to support FRDA, our evaluation indicated that concerns continue to be expressed by both Federal and Provincial government personnel regarding the level of human resources that were available to implement the Agreement. Until recently, staff levels at the British Columbia Ministry of Forests have been declining, resulting in heavy work loads for those responsible for

implementing the Agreement. Staffing shortages were felt most at the Ministry's district level. These shortages were addressed partially in 1989/90, when the Provincial Treasury Board approved the hiring of an additional 49 staff (approximately one per district). These positions have been hired on a temporary basis and we understand that the positions may be terminated at the end of the Agreement.

At the federal level, Forestry Canada assigned one officer to each of the Indian Lands and Private Lands programs. The officers were responsible for managing all of the expenditures and activities of these programs. An additional person-year was added to each of the Indian Lands and Private Lands programs in 1988/89 in recognition of the work loads associated with delivery of these programs.

Finally, the five year time frame of the Agreement was identified by many as a limitation on the potential cost-effectiveness of the expenditures and activities that have been undertaken. This results from the need to protect and maximize the investments that have been made, through on going forest management. It was clearly evident from our discussions with forestry experts that the impact on forest yields will be diminished if further actions are not taken on an on going basis beyond the term of the Agreement.

Also, the five year time frame was a concern to those involved in research and development projects funded by the Agreement. Our evaluation findings indicated that longer-term research projects, which may have entailed a funding Commitment beyond five years, were neither encouraged nor supported by the Agreement. The requirement for research projects to produce demonstrable results before the end of the Agreement tended to restrict the scope of the research and development projects that were supported.

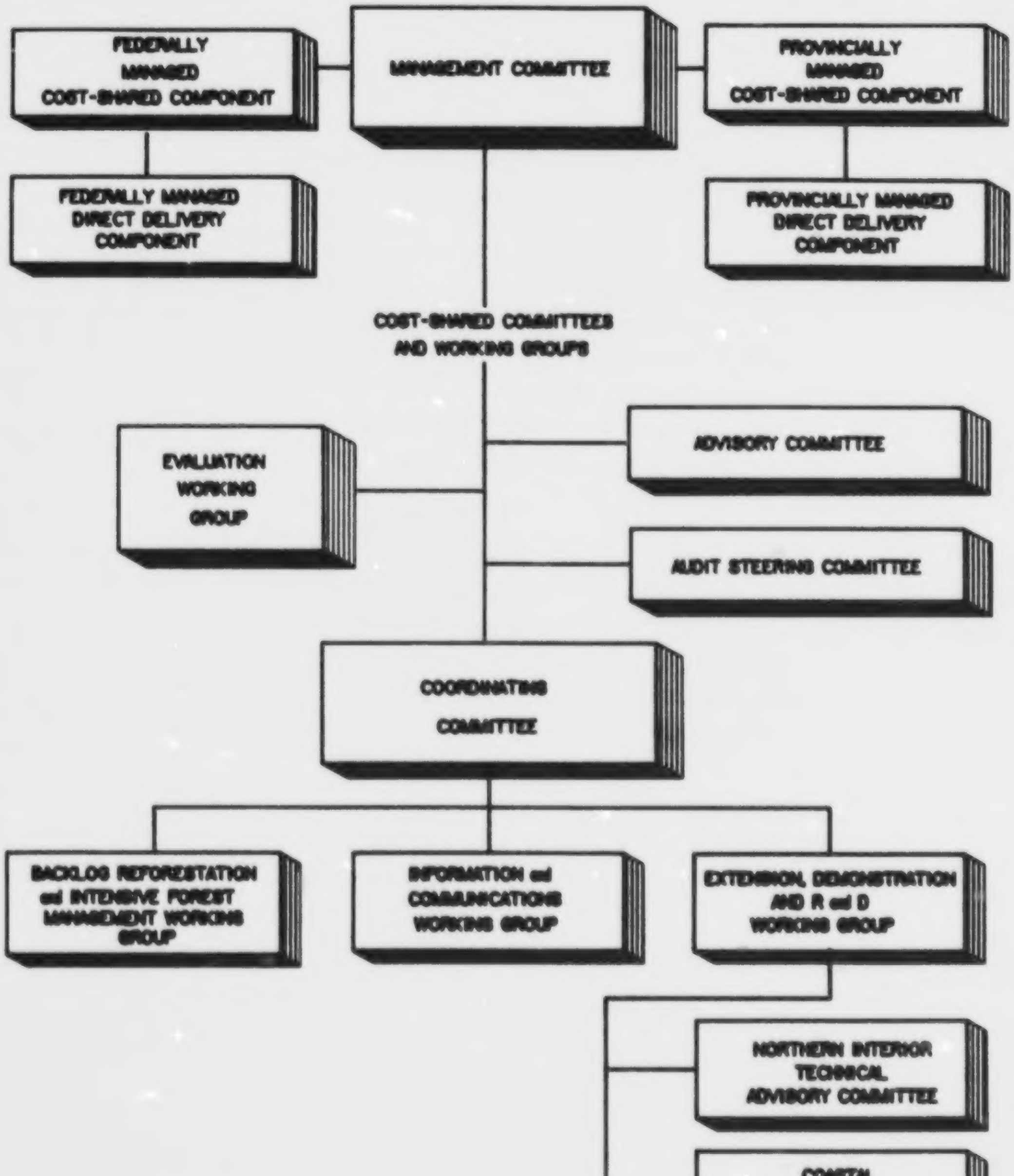
Recommendations

2. **A future forest resource development agreement should be developed framework the context of a formal, long-term (20 years or more) strategic forest resource management direction for the British Columbia forestry sector which establishes clear priorities for the forestry sector, within the framework of broad economic, social and environmental considerations.**

XHIB

CANADA - BRITISH COLUMBIA FOREST RESOURCE
DEVELOPMENT AGREEMENT, 1985 - 1990

MANAGEMENT STRUCTURE


FEDERALLY MANAGED COST-SHARED COMPONENT
MANAGEMENT COMMITTEE
PROVINCIALLY MANAGED COST-SHARED COMPONENT
FEDERALLY MANAGED DIRECT DELIVERY COMPONENT
PROVINCIALLY MANAGED DIRECT DELIVERY COMPONENT
COST-SHARED COMMITTEES AND WORKING GROUPS
EVALUATION WORKING GROUP
ADVISORY COMMITTEE
AUDIT STEERING COMMITTEE
COORDINATING COMMITTEE
BACKLOG REFORESTATION and INTENSIVE FOREST MANAGEMENT WORKING GROUP
INFORMATION and COMMUNICATIONS WORKING GROUP
EXTENSION, DEMONSTRATION AND R and D WORKING GROUP
NORTHERN INTERIOR TECHNICAL ADVISORY COMMITTEE
COASTAL TECHNICAL ADVISORY COMMITTEE
SOUTHERN INTERIOR TECHNICAL ADVISORY COMMITTEE

3. A new agreement should be supported by formal, comprehensive and appropriately funded, strategic and operational planning processes and should incorporate mechanisms for determining economic returns and achievements likely to result from planned expenditures on sites, treatments and species, as well as forestry and economic criteria for establishing priorities within regions and districts.

4. The British Columbia Ministry of Forests and Forestry Canada should ensure that adequate levels of human resources are available to support fully the management and delivery expectations of a future agreement.

A.3. Management Structures and Administrative Practices

Findings and Conclusions

It was evident from our evaluation that the management and advisory committees and working groups established to support the management and delivery of the Agreement functioned effectively. These structures are illustrated in Exhibit 2, opposite. In particular, the equivalent status of federal and provincial representation on the Management Committee contributed to the effective cooperation and coordination of the two governments. There are, however, some areas where the committee and working group structures can be improved.

We noted that the Management Committee focused almost exclusively on the cost-shared ($240 million) component of the Agreement, and monitored the direct delivery components of the Agreement only to a limited degree. It was apparent from our review that there were opportunities to improve the coordination of the cost-shared and direct delivery components through an increased involvement of the Management Committee in overseeing the plans and activities of each of the direct delivery programs. This is supported by the fact that significant components of the direct delivery programs (e.g. Private Lands Program) were not supported by formal planning or priority setting processes.

The mechanism used to provide external parties with input into the management and delivery of the Agreement has not been fully effective. The FRDA Advisory Committee consists of 15-20 representatives from industry associations, labour, private firms, and some government agencies. This Committee was established part-way through the Agreement, in response to a desire on the part of various interested parties to have more direct participation in the Agreement. Since the Committee was established after many important decisions had been made regarding the direction and priorities of the Agreement, it has played, as intended, an advisory role. Expanding their input, participation and operational role is a serious consideration in a future agreement .

With respect to administrative practices, our evaluation indicated that appropriate policies and procedures to guide program delivery have been developed. Specifically, the Agreement has been supported by formal policies and procedures, including: the Backlog Reforestation Intensive Forest Management Working Group (BRIFM) guidelines; as well as the Ministry silviculture and contractors manuals. These policies and guidelines appear to have functioned appropriately. However, our interviews indicated that some operational-level personnel were unaware of the existence of these guidelines and manuals.

Recommendations

5. A future forestry agreement should be directed by a joint federal-provincial management committee, which is clearly accountable for directing all cost-shared programs and for coordinating the cost-shared and direct delivery program activities.

6. A future agreement should be supported by an advisory committee representing the views of key interest groups in the Province (e.g. industry, labour, environment) and that participates and provides input to the decision making processes.

A.4. Information Management and Communication

Findings and Conclusions

Our evaluation indicated that a considerable amount of data and information on the outputs, activities and expenditures of the Agreement have been reported regularly to the Management Committee. For the most part, these data and information have been relevant, timely and accurate. However, there are shortcomings in the information that is reported to management.

Although there is an appropriate level of information available on FRDA expenditures and activities, including numbers of hectares treated and trees planted under each of the components of the Agreement, there is a lack of complete and comprehensive information for operational use on the results and benefits achieved by these various activities. Specifically, the growth and yield impacts of the Agreement are not measured, recorded and reported to management. As a result, it is difficult to compile operationally useful information on the overall contribution that these expenditures and activities, under the Agreement, have made to the provincial long-run sustainable yield. In addition, an absence of cost-benefit analyses of FRDA expenditures significantly limits the ability of management to assess the potential economic returns from silviculture investments.

Though it was intended in the Agreement, an overall pilot-scale growth and yield study was not conducted. However, in an effort to overcome the shortcomings in existing growth and yield data, the Agreement has funded some projects aimed at estimating the contribution of various forestry management activities to the long-run wood supply. (We have relied on the findings of two of these studies to prepare our estimate of the incremental wood supply resulting from the Agreement, as presented in B.2 Wood Supply.) The findings of these studies have not resulted in the establishment of an on going process of monitoring and reporting on the estimated contribution of FRDA activities to the long-run wood supply.

The lack of growth and yield data is not limited to FRDA. Previous studies, including the Task Force to the Chief Forester on Incremental Silviculture (September 1988) have pointed to deficiencies in overall provincial growth and yield information. These deficiencies generally are seen as representing major limitations in the information available to support silviculture investments.

An important implication of the shortcomings in growth and yield information is a lack of common understanding of the impacts that specific silviculture activities are likely to have on long-run wood supply. This has the further implication of limiting the extent to which the costs and benefits of alternative expenditures can be evaluated.

Our review determined that the Ministry's History Records Systems provide the opportunity to collect information on FRDA activities but not enough to determine growth and yield responses at the stand level. Moreover, these records maintain data only on cost-shared programs and do not incorporate any FRDA work done on Tree Farm Licences or federal direct delivery programs. Separate systems and processes have been developed to assemble and record FRDA information and to support the preparation of Quarterly Status Reports for management. We identified timing differences in the data contained in the two systems resulting in inconsistencies in reported Ministry data.

Also, Forestry Canada has developed DEVMIS, a system to record information on the Indian Land and Private Land Programs landbase. There is no link between the Ministry of Forests and Forestry Canada databases. Linking these databases in future would alleviate the need to calculate impacts independently and separately.

With respect to external communications, a five year Communications Plan was developed for the Agreement but never effectively implemented because of differing internal views on its appropriateness. Notwithstanding this constraint, a wide range of external communications activities have been conducted, including: publishing and distributing the Agreement Newsletter Renewal; preparing and issuing a series of news releases and newspaper ads for all print and electronic media throughout the Province; developing poster displays used at Ministry and Forestry Canada offices, national forestry week, and other trade shows and workshops; preparing and distributing a series of articles featuring research programs of the Agreement; and, funding non-profit organizations throughout the Province to support local forestry public awareness projects.

A recent evaluation of the communications elements of Forest Resource Development Agreements across Canada, commissioned by Agriculture Canada, indicated that the British Columbia Agreement had the lowest percentage of total funds allocated to Communications (0.7 percent). With a communications budget of $2 million, the British Columbia agreement was among the highest of any provincial agreement in terms of absolute funds provided for communications. The same evaluation indicated a high level of awareness of forestry issues within the Provincial population, however as with the

other provinces, the British Columbia population has a relatively low level of awareness of FRDA. Despite the positive initiatives taken with respect to Communications, it is our view, considering the large size of the British Columbia FRDA, that insufficient funding was provided to this sub-program of the Agreement.

Recommendations

7. **A future forest resource development agreement should include a requirement for the development and use of appropriate and coordinated operational use methodologies, processes and systems to predict, monitor and report annually on estimated rotation length growth and yield achievements of alternative silvicultural regimes.**

8. **In order to ensure that the objectives, activities and achievements of a future agreement are communicated effectively and clearly to interested parties, including the general public, external communications should be an important element of any future agreement and should be supported by funding appropriate to the size of the total agreement value.**

A. 5. Program Delivery and Implementation

Findings and Conclusions

Our evaluation revealed a wide-spread perception among representatives from the two levels of government, the academic community, industry and labour that the Agreement has been implemented effectively, in general compliance with the conditions of the Agreement. Our evaluation supports this assessment. However, we have identified some areas where improvements can be made to program delivery and implementation. Many of these have already been discussed in this report and relate mainly to the cost-shared programs of the Agreement, reflecting the fact that 80 percent of FRDA funds are delivered through this component. Our evaluation has, however, identified issues related specifically to the implementation of the direct delivery programs. These issues are limited to the federal lands programs (i.e. Private Forest Lands and Indian Forest Lands).

The Private and Indian lands programs of the federal direct delivery component of the Agreement have made an important contribution to the British Columbia forestry sector in the form of increased recognition of the forestry potential on these lands. In addition, it is apparent that opportunities exist to expand these programs under a future agreement. Should this occur, it will be necessary to ensure that formal planning processes are introduced to support new programs, and that mechanisms are in place to coordinate these programs with provincial and cost-shared activities.

The Private Lands Program (PLP), for example, was not supported by a formal process or criteria to guide the allocation of funds. In general, under the PLP, funds were distributed on a first-come first-served basis and have been committed fully. As a result, issues such as the economic viability of funded projects, or the relative needs of areas to be supported, were not assessed formally. The formation of a Private Lands Association has helped to improve the communications of requirements and issues.

With respect to the Indian Lands Program (ILP), a number of shortcomings were identified in a review of ILP conducted by Allen Hopwood Enterprises Ltd. in April 1988. The review was commissioned largely in response to a relatively low utilization of the program. Although a number of positive features of the program were identified (e.g. significant increases in the number of forest inventories and plans prepared by Bands) some problems also were indicated.

One of the major difficulties in utilization of the fund was the requirement that Indian Bands contribute 20 percent of project budgets. In many cases, bands were unable to raise the required 20 percent. Some Bands overcame this problem by obtaining funding from the Canada Employment and Immigration Commission (CEIC) and other employment programs. This created a new set of problems related to the availability, eligibility requirements and timing of these programs. Also, concerns were raised, with respect to: adminstration of the program; shortages of technical expertise; and the desire for multi-use resource management.

Our evaluation indicated that the funds allocated to the ILP are expected to be utilized fully, indicating that some of the more significant problems experienced early in the term of the Agreement have been overcome. In addition, the Intertribal Forestry Association, created in 1986, has taken strong initiatives to support the program and its continuance. However, if the ILP is to be extended, it is likely that issues related to program eligibility, technical expertise and the environment will continue to be important concerns within native communities.

Recommendation

9. Private and Indian Land programs should be included in a future agreement and together with other direct delivery programs should be supported by formal planning and monitoring processes, appropriate administrative policies, and should be coordinated fully with cost-shared programs.

B. FORESTRY MANAGEMENT

A major component of our evaluation was an analysis and assessment of the forestry impacts of the Agreement. Given the relative emphasis that silviculture activities and increased wood supply received in the Agreement, our evaluation focused most heavily on these areas. In addition, environmental protection was identified as a condition of the Agreement and, therefore, was also the subject of our evaluation. Our findings with respect to forestry management are organized into the following three groups:

- silviculture activities;
- wood supply; and,
- environmental impacts.

In presenting our evaluation of each area, we begin with an overview of the context in which our assessment was conducted. This includes a synopsis of the objectives of the Agreement with respect to each area, and the approach we followed in conducting our review. We then present our findings and conclusions, followed by our recommendations where appropriate.

B.1. Silviculture Activities

As discussed previously in this report, a key element of the Agreement was to "sustain and increase the forest resource". Two specific objectives were stated in the Agreement: "manage part of the backlog of non-satisfactorily restocked lands in the Province; and, intensively manage selected forest stands". In addition, a number of specific goals were stated in Schedule A of the Agreement.

The Ministry's History Records System provides data on the sites, species and types of treatment for each region, over the five year period. We used these data to obtain information on the site-specific location and costs of silviculture activities supported by the Agreement.

SILVICULTURE ACTIVITIES
(OOO'S OF HECTARES)

		FEDERAL DIRECT DELIVERY	PROVINCIAL DIRECT DELIVERY	COST-SHARED			TOTAL
		Actual	Actual	Revised Plan	Actual	Variance (%)	Actual
1.	BACKLOG REFORESTATION						
1.1	SURVEYS & PRESCRIPTIONS	271.3[1]	-	759.9	890.2	17%	1,161.5
1.2	SEEDLINGS (MILLIONS OF TREES)	N.A.	-	172.0	163.0	(5%)	163.0
1.3	SITE PREPARATION	3.6	-	140.1	121.1	(14%)	124.7
1.4	PLANTING	1.3	-	131.2	137.1	1%	138.4
1.5	IMPLEMENTATION	-	-	-	-	-	-
1.6	EXT., DEMO & R&D	-	-	-	-	-	-
2.	INTENSIVE FOREST MANAGEMENT						
2.1	BRUSHING, WEEDING & PEST CONTROL	1.2	-	28.5	29.8	5%	31.0
2.2	CONIFER RELEASE	0.7	-	8.1	5.7	(30%)	6.4
2.3a	JUVENILE SPACING	5.2	-	57.4	53.7	(6%)	58.9
2.3b	ALLOCATION TO TFL'S	-	-	N.A.	6.7	N.A.	6.7
2.4	FERTILIZATION	1.5	-	47.4	45.6	(4%)	47.1
2.5	IMPLEMENTATION						
2.6	EXT., DEMO & R&D	-	-	-	-	-	-

NOTE: Specific goals were not established for Direct Delivery Programs.

[1] This covers management plans as well as field surveys.

N.A. Not available

Our review also included an examination of the likely net economic returns from silviculture expenditures. In conducting this assessment, however, we identified an absence of adequate and complete information or economic analysis to support expenditure decisions that were made under the Agreement. Therefore, in an attempt to determine the likely returns from these investments at a microeconomic level, we undertook limited economic case studies of selected FRDA expenditures.

Findings and Conclusions

Our analysis indicates that most of the specific forestry management goals of the Agreement have been achieved. In Exhibit 3, opposite, we present the actual hectares treated and trees planted over the term of the Agreement for the direct delivery and cost-shared programs.

The provincial direct delivery program did not involve operational silviculture treatments. Rather, these funds were used largely to support field and nursery testing and the construction of new research facilities.

Specific goals were established only for the cost-shared activities, which accounted for 80 percent of the Agreement funds. Some of the goals set out in the Agreement were revised by the Management Committee to take into account new information and changes in priorities. The most significant goal change was with respect to surveys and prescriptions for which the Management Committee approved a three-fold increase in the amount of hectares to be surveyed. This positive initiative was to allow the Province to identify all appropriate NSR land and to have suitable plans developed to address their silviculture needs.

As shown in the Exhibit opposite, implementation of the Agreement has been essentially on target for a number of planned silviculture activities or tasks, including site preparation, planting, brushing/weeding, and spacing. Even though the Agreement has supported a considerable level of silviculture activity in the Province, full benefits will only result from these activities if further actions are taken to continue to treat stands over the rotation period.

SILVICULTURE ACTIVITIES, BY REGION
(OOO'S OF HECTARES)

	CARIBOO	KAMLOOPS	NELSON	PR. GEORGE	PR. RUPERT	VANCOUVER	TOTAL
1.0 BACKLOG REFORESTATION							
1.1 SURVEYS & PRESCRIPTIONS	163.6	259.6	162.0	306.3	115.3	154.7	1,161.5
1.2 SEEDLINGS (MILLIONS OF TREES)	18.4	24.2	31.5	68.6	14.6	5.7	163.0
1.3 SITE PREPARATION	12.5	9.8	18.2	65.4	14.8	4.0	124.7
1.4 PLANTING	14.2	19.9	29.2	55.2	13.2	6.7	138.4
1.5 IMPLEMENTATION	-	-	-	-	-	-	-
1.6 EXT., DEMO & R&D	-	-	-	-	-	-	-
2.0 INTENSIVE FOREST MANAGEMENT							
2.1 BRUSHING, WEEDING & PEST CONTROL	0.7	4.6	1.6	9.6	5.2	9.3	31.0
2.2 CONIFER RELEASE	1.0	0.8	0.5	1.8	0.9	1.4	6.4
2.3a JUVENILE SPACING	13.1	8.4	6.6	7.5	7.6	15.7	58.9
2.3b ALLOCATION TO TFL'S	0.2	0.7	0.5	0.6	0.4	4.3	6.7
2.4 FERTILIZATION	5.3	3.6	5.6	7.8	6.5	18.3	47.1
2.5 IMPLEMENTATION	-	-	-	-	-	-	-
2.6 EXT., DEMO & R&D	-	-	-	-	-	-	-
TOTAL HECTARES	210.6	307.4	224.2	454.2	163.9	214.4	1,574.7

We present the actual silviculture activities performed in each region, in Exhibit 4, opposite. The Exhibit indicates that silviculture activities were spread across all regions of the Province and that all regions received the full range of treatments. Although variances exist with respect to the level of treatment provided in each region, our evaluation indicated that these variances are generally appropriate and can be attributed largely to the different levels of NSR land in each region and the relative forestry needs and economic conditions of the regions.

The silviculture activities funded by the Agreement generally appear to have been delivered within planned cost estimates. Exhibit 5, overleaf, presents a summary of the average unit costs for silviculture activities performed under the cost-shared programs. Our evaluation indicated that the costs of the silviculture activities were performed consistent with the levels anticipated under revised budgets for the Agreement.

The costs under the Agreement are consistent with those for other Ministry programs and silviculture activities, as contained in the Ministry History Records System. In addition, these costs appear to be roughly comparable to industry norms under comparable conditions. This reflects the fact that most activities were delivered by private sector firms on a contract basis. There is, however, a general absence of empirical data to conduct a full comparison with standard industry costs.

With respect to the financial or economic returns on individual silviculture expenditures, it is evident from our review that analyses of the costs and benefits of projects and activities were not conducted under the Agreement. In our view, this is a major shortcoming in the information that is available to support and evaluate expenditure decisions relative to silviculture activities.

In an attempt to determine if silviculture activities are likely to generate positive returns at the microeconomic or project level, we undertook limited case studies of selected projects. The selected projects represented the largest areas treated in each region. While our analysis of returns on investment was not intended to be comprehensive nor to address overall forestry dynamics and management issues, the results are broadly indicative of the net economic gains that are likely to be achieved at the project level if factors such as treatment costs, carrying costs, physical responses and log prices are taken into account.

EXHIBIT 5

UNIT COSTS OF COST-SHARED SILVICULTURE ACTIVITIES

		ADJUSTED PLAN AT MID-POINT	FORECASTED ACTUAL	VARIANCE	
				DOLLAR	PERCENT
1.0	BACKLOG REFORESTATION				
1.1	SURVEYS & PRESCRIPTIONS	$ 14.22	$ 13.97	($ 0.25)	(1.8%)
1.2	SEEDLINGS	$ 0.17	$ 0.19	$ 0.02	11.8%
1.3	SITE PREPARATION	$385.25	$372.82	($ 12.43)	(3.2%)
1.4	PLANTING	$361.78	$396.80	$ 35.02	9.7%
1.5	IMPLEMENTATION	N.A.	N.A.	N.A.	N.A.
1.6	EXT., DEMO. & R&D	N.A.	N.A.	N.A.	N.A.
2.0	INTENSIVE FOREST MANAGEMENT				
2.1	BRUSHING, WEEDING & PEST CONTROL	$272.73	$374.83	$102.10	37.4%
2.2	CONIFER RELEASE	$703.24	$639.91	($ 63.33)	(9.0%)
2.3a	JUVENILE SPACING	$584.74	$624.86	$ 40.12	6.9%
2.3b	ALLOCATION TO TFL'S	N.A.	N.A.	N.A.	N.A.
2.4	FERTILIZATION	$203.43	$204.63	$ 1.20	0.6%
2.5	IMPLEMENTATION	N.A.	N.A.	N.A.	N.A.
2.6	EXT., DEMO. & R&D	N.A.	N.A.	N.A.	N.A.

Note: All costs are per hectare treated, except seedlings which are per tree planted.

N.A. Not Applicable

Based on our analysis, it is apparent that a range of economic returns are likely to result from the projects we studied. Of the 27 cases that were assessed, 21 can be expected to have positive economic returns. Our analysis indicates, however, that the remaining 6 projects are likely to produce minor negative net economic returns. More detailed results of our analysis are presented in Appendix A.

We believe that economic or financial analyses of significant expenditure proposals should be conducted before funding is approved for projects. Had this type of assessment been conducted, it is likely that alternative expenditure decisions would have been supported in some instances.

Recommendations

10. A future agreement should make provisions for the continued management of lands that received silviculture treatments under the current Agreement and a monitoring system of annual technical audits based on criteria developed from sound forest management principles, including yield and economic impacts, should be included.

11. Significant silviculture investments made under a future agreement should be supported by appropriate financial and economic cost-benefit analysis within an established and consistent analytical framework.

B.2. Wood Supply

Consistent with the terms of reference for this evaluation, our approach to assessing the contribution of the Agreement to wood supply in the Province focused on determining the impact on backlog NSR land and estimating the resulting increase to long-run sustainable yield, as defined by Ministry of Forests procedures. In addition, we reviewed the impact that the Agreement is likely to have on wood quality. In each case we relied heavily on interviews, existing data and information contained in reports from previous FRDA studies, as well as the Ministry of Forests History Records System.

In order to estimate the increase in long-run sustainable yield (LRSY) expected to result from the Agreement, we conducted a detailed analysis that involved combining the results from previous FRDA growth and yield studies with Ministry of Forests' history records, as well as other general yield information.

Our approach enabled us to produce detailed yield information by region, silviculture treatment, and species. We produced this level of information for estimated stand responses for each of five major treatments: site preparation; planting; brushing and weeding (including conifer release); spacing; and, fertilization. In Appendix A, we provide a detailed discussion of our approach, methodology and findings.

Findings and Conclusions

In our view, there are three main issues to be examined in an evaluation of the impact that the Agreement has had on wood supply. These are as follows:

- the extent to which the backlog NSR has been reduced;
- the estimated increase in long-run sustainable yield expected to result from the Agreement; and,
- improvements in the quality and value of wood that are likely to occur as a result of the Agreement.

Backlog NSR

Ministry data indicates that the level of backlog NSR land on medium and good sites in the Province was reduced by almost one-quarter over the first three years of the Agreement. The level is estimated to have decreased from 738,000 ha in 1984 (adjusted from 644,552 ha in the Agreement document) to 553,100 ha in September 1988. This reduction reflected the planting of approximately 69,000 ha during the first three years

of the Agreement. However, the majority of the reduction in backlog NSR on medium and good sites (115,900 ha) over the first three years was attributed to the reclassification of lands, following the completion of surveys conducted under the Agreement. This reflects a very positive result from conducting the surveys at an early stage in the Agreement.

It is estimated by the Ministry that a total of 138,400 ha will be planted by the end of the Agreement. This is roughly equivalent to the planned level, and represents the planting of approximately 163 million seedlings, also essentially equal to the planned level.

Our evaluation confirmed that in addition to administering the Agreement, the Province has maintained its commitment to basic silvicultural programs. This is consistent with the conditions of the Agreement, and reflects an attempt to ensure that there is no net increase to the NSR backlog while the Agreement is in effect.

As part of this commitment, the Province introduced new regulations in October 1987 requiring all major licensees to reforest all cut-over lands on their licences at their expense. In addition, the Ministry increased the size of its annual reforestation programs on lands harvested between January 1982 (the cut off for the FRDA NSR backlog) and October 1987 (the point at which industry was required to conduct its own reforestation).

Assuming that no further significant reclassification of lands has occurred since September 1988, and that no net increase in the backlog has taken place, it is likely that the backlog NSR remaining on good to medium sites at the conclusion of the Agreement will be in the order of 483,700 ha. (This has been calculated by subtracting the hectares planted since 1988 from the estimated hectares of backlog NSR at that time.) Therefore, even though the Agreement achieved its planting objectives, even more reforestation will be required if the Province is to eliminate the entire backlog.

Long-Run Sustainable Yield

The Agreement established as a specific goal the addition of "about 600,000 m^3 annually to the long-run sustainable yield". Therefore, a central part of our evaluation related to determining if this goal has been achieved. As discussed earlier, however, the Agreement is not specifically supported by formal monitoring and reporting of growth and yield statistics. Therefore, we were requested to estimate the incremental wood supply resulting from the Agreement.

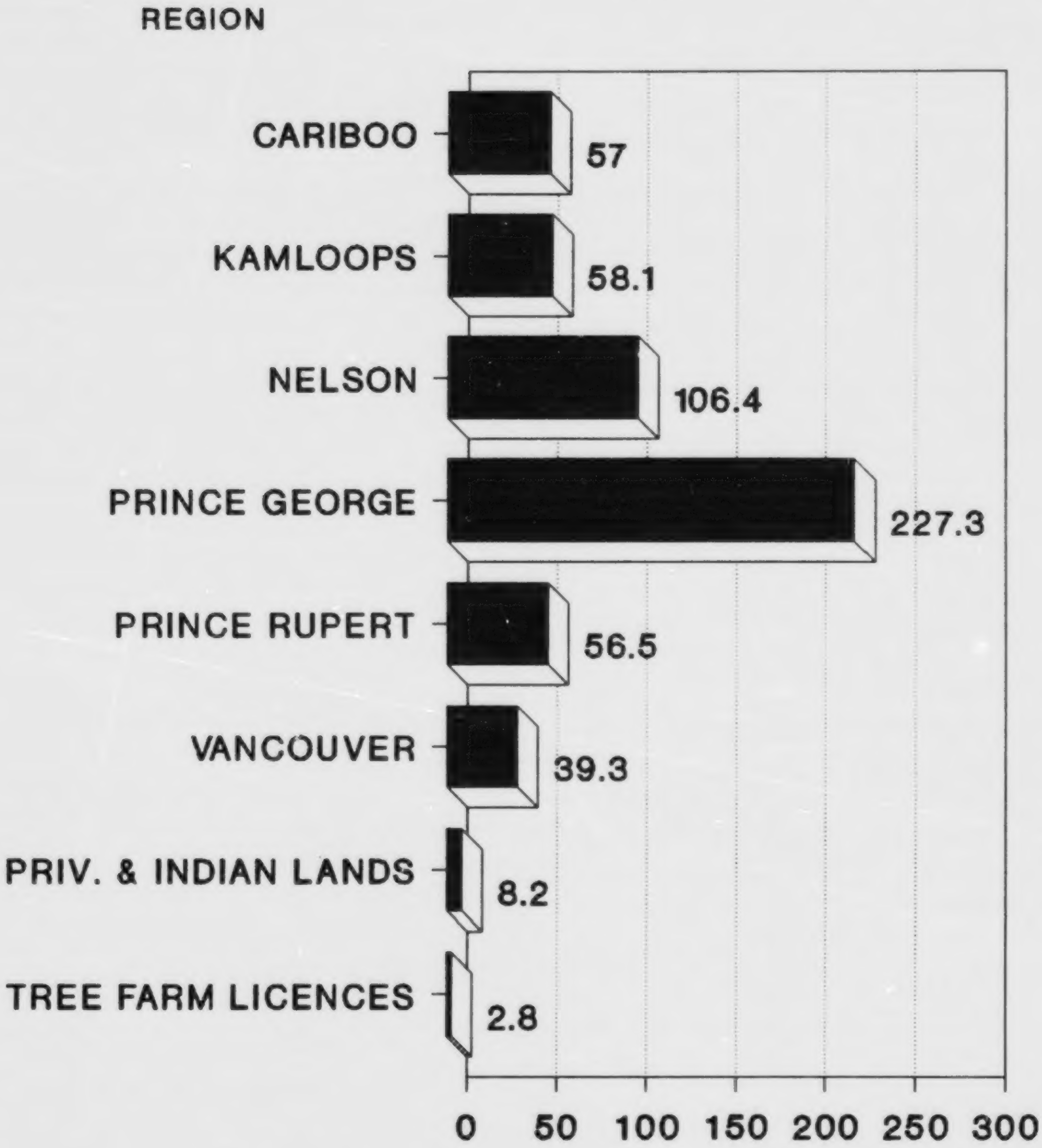
In order to assess whether the 600,000 m^3 goal was achieved, we followed the approach to estimating long-run sustainable yield used by the Ministry. It is our understanding that this approach is generally consistent with the assumptions implied in the original 600,000 m^3 goal. The approach involved adopting the Ministry methodology and assumptions for estimating the expected impacts of various silviculture activities on growth and yield.

The physical production forecasts of the Ministry are based on complex computer simulations of forest growth and harvest for individual Timber Supply Areas and Tree Farm Licences. Specific management policies and constraints are used in each simulation. For example, unstocked lands (including NSR) are usually excluded from the calculation as providing no commercial yield. The major implication of this on growth and yield calculations is that projected gains due to reforestation are added to the long-run sustainable yield at the time that successful reforestation occurs, while natural growth on NSR land is not included in Ministry projections.

It is important to note, however, that significant differences of opinion exist within the forestry community as to the methodologies and assumptions that best approximate future rotation length growth and yield outcomes that are likely to result from silviculture activities. For example, should the effects of changes in soil organic matter and fertility during the NSR period or the impact thereon of site preparation treatments be considered? It is our understanding that the approach adopted by the Ministry does not take these into account.

XH 6

ESTIMATED ANNUAL INCREMENTAL WOOD SUPPLY RESULTING FROM FRDA ACTIVITIES (000'S OF M^3, MAI)



MAI - MEAN ANNUAL INCREMENT

Our evaluation indicates that the Agreement is likely to essentially achieve the target for incremental wood supply. Specifically, our analysis indicates that once the results of FRDA related activities are incorporated into future timber supply analysis by the Ministry of Forests, an increase to the long-run sustainable yield of 555,600 m^3 or almost 93 percent of the intended goal may be achieved. This estimate has been prepared using standard Ministry of Forests methodology for calculating yield increments and yield tables produced by FRDA. Our detailed findings supporting this estimate are presented in Appendix A. In Exhibit 6, opposite, the intended annual incremental wood supply resulting from FRDA activities by region, is presented.

There are significant potential economic benefits to be realized from the increased level of wood supply resulting from the Agreement, as discussed under ECONOMIC IMPACTS presented later in this report.

It is of course possible that some increased wood supply might have occurred on NSR treated lands without the silviculture activities performed under the Agreement, since treatments of NSR lands sometimes involved the removal of natural growth prior to replanting or fill-in planting of areas that were stocked partially with natural growth. Therefore, we attempted to estimate the natural incremental wood supply that might have occurred had there not been FRDA treatments in some areas.

We estimate that, in net terms, an untreated natural yield rate equal to about 20 percent of the FRDA achievement might have occurred had sites received no treatments. The extent to which these rates are significant cannot be fully determined given the limitations of current growth and yield information and history records of sites before and after treatments.

Quality and Value of Wood

The issue of wood quality is not addressed in detail in the Agreement. However, it is generally accepted in the industry that increases in wood volume are not the only possible gains from silviculture investments. Changes in species, log size, and effective time of harvest can also be achieved. These can be important determinants of wood quality. Improvements in wood quality that are achieved through intensive forest management practices can increase the economic value of wood supplies.

It was evident during our evaluation that there is a significant lack of empirical data on the impact that silviculture practices have on wood quality and, more specifically, the changes in the economic value of wood that can result from changes in tree size and time of harvest caused by intensive forest management practices. Data specifically related to the impacts of FRDA on wood quality are extremely limited, and do not provide a reasonable basis for developing general conclusions.

A limited amount of study has been commissioned under the Agreement to address issues related to wood quality. In general, these studies have raised important issues related to the relative returns resulting from improved quality of wood, as compared to increased quantity or volume. However, a definitive pattern has yet to emerge from the research that has been conducted under FRDA.

There is at least one potential negative impact of silviculture treatments on wood quality. If a silvicultural treatment (e.g. thinning/fertilization) increases the width of annual growth rings or increases the proportion of juvenile wood to a marked degree, a decline in quality can occur. However, it does not appear that this has occurred from FRDA activities, since the bulk of the sites/treatments involved are not expected to exceed the current market constraints on rings per inch or juvenile wood proportion. In addition, the real future markets expected at the time of harvest will likely be better adjusted to second growth wood than are present markets.

Given the considerable lack of baseline data against which detailed issues of wood quality could be assessed (ie. ring width, specific gravity and fibre length), we were not able to conduct an analysis of the impact that FRDA will have on wood quality. However, as discussed earlier, we did conduct a microeconomic analysis based on selected case studies of the costs and performance of actual projects, to determine the economic returns resulting from FRDA expenditures.

Recommendations

12. **A future forestry agreement should have as a priority the continuation of programs aimed at reducing the backlog NSR, on economically viable sites, focused at specific regional yield goals.**

13. **A future agreement should include the requirement to develop and document a formal methodology for estimating rotation length growth and yield impacts resulting from the silviculture activities to be supported by an agreement and should be appropriate to support economic analysis of expenditures made under an agreement.**

14. **Defining what "better" wood quality really means and assessing the impact of silviculture practices on wood quality, and the resulting affects on the value of wood produced, should be an important consideration of a future agreement.**

B.3. Environmental Impacts

It is clear that the Agreement was to be implemented consistent with existing environmental policies. Specifically, Section 9 of the Agreement sets out the requirement for all projects funded by FRDA to follow the content of both the Environmental Assessment and Review Process and the Provincial Environmental Impact Assessment Policy.

In assessing the degree to which the Agreement has been in compliance with this provision, we relied heavily on our broad interview program, including discussions with British Columbia Ministry of Environment officials. In addition, we reviewed existing documentation relevant to environmental issues. The focus of our approach was to assess the environmental provisions of the Agreement, the general level of awareness of these provisions and the methods used to assess environmental impacts.

Findings and Conclusions

It was apparent from our evaluation that FRDA silviculture activities were monitored and assessed from an environmental perspective in a manner that was largely consistent with the approach used for Ministry of Forests programs. This involved referral assessments prior to work being undertaken. These assessments were not at the project level but were at a management plan level where approvals could be given for the general strategy

of the activity. In general, we did not identify instances of potential negative environmental consequences from FRDA activities. We did note, however, that in very few cases did the Ministry of Environment review a project after its completion to determine the actual environmental impacts.

We identified some concerns regarding the impact of FRDA referral assessments on Ministry of Environment personnel, and their ability to respond effectively. The volume of the referrals was significant and added to the base workload of the normal operations of the Ministry of Environment. The level of funding provided to the Environment Ministry to support this additional workload was insufficient to implement fully a comprehensive environmental assessment function for the Agreement. The funding that was received was used mainly to conduct referral assessments and some funds went toward environmental planning and development of inventories. Both were consistent with the intent of the Agreement.

There is a general recognition within the forestry sector that future forestry agreements will have to adopt a more broad-based approach to forest resource management (i.e. beyond backlog reforestation and intensive forest management) if issues related to integrated resource management are to be addressed adequately. This is especially important given the increasing sensitivities that exist with respect to the potential environmental consequences of some intensive forest management practices.

Acknowledging the constraints of limited financial resources, it is evident that the Agreement was unable to adequately support environmental planning at the Provincial and regional levels. It is likely in future that environmental planning at these levels could ensure that adequate assessments are made of significant resource and habitat concerns.

Recommendation

15. **A future agreement should provide sufficient funding to implement a comprehensive environmental assessment function which involves a process of environmental resource planning and monitoring at the Provincial and regional levels and should be conducted from an integrated resource management perspective that takes into account natural resource and habitat conditions while effectively supporting silviculture practices.**

C. ECONOMIC IMPACTS

The economic impacts of the Agreement in terms of its contribution to the local, provincial and national economies was an important focus of our evaluation. In conducting our study, we have made the broad assumption that the increase in the annual long-run sustainable yield generated through the forest renewal and management programs of the Agreement will have a direct impact on forestry production. Therefore, we have based our estimates on the total estimated incremental yield resulting from FRDA activities (i.e. 555,600 m^3).

We have organized the results of our evaluation into the following main areas:

- employment and general economic performance; and,
- forestry-dependent communities.

As with the previous section on forestry management, our discussion of each of the above topics begins with a summary of the context in which our assessment was conducted. We then present our findings and conclusions, followed by our recommendations, as appropriate.

C.1. Employment and General Economic Performance

A major thrust of the Agreement was to provide short and long-term solutions to the socio-economic problems facing the forest industry and the Province in the mid 1980s. As a result, a key element of the Agreement's overall objective was to "strengthen the employment potential of the forest industry". Two quantitative targets were set out in the Agreement:

- "maintain approximately 500 permanent full-time jobs while generating short-term employment for at least 15,000 persons".

Consistent with the requirements for this study, our analysis of the contribution of the Agreement to employment and general economic performance relied heavily on existing data and research studies. A further discussion of our approach, methodology and findings is presented in Appendix B.

It is important to note that our estimates of economic benefits resulting from the incremental wood supply (i.e. permanent employment and contribution to gross domestic product) assume that all growth is achieved on managed public forest estates where anticipated future yields result in immediate increases to current production levels.

Findings and Conclusions

Our principal findings and conclusions with respect to the economic impacts of the Agreement relate to the following topics:

- employment;
- gross domestic product; and,
- the silviculture industry.

Employment

The Agreement has not been supported by systems or approaches to measure the permanent employment created by its investments. In addition, although short-term employment standards have been developed for specific FRDA projects, they are limited to direct employment only. Given the importance attached to job creation under the Agreement, this can be considered a significant shortcoming of the information available to monitor and assess achievements.

XHI 7

ESTIMATED POTENTIAL PERMANENT EMPLOYMENT CREATED BY FRDA

	JOBS
British Columbia	
- Direct permanent employment:	500
- Indirect permanent employment	544
	1,044
Other Provinces	406
Total	1,450

Based on our evaluation, once the incremental yield is recognized in timber supply analysis and is being harvested, it is evident the Agreement will likely generate permanent and short-term employment well in excess of planned levels. Relying on previous research findings, we determined that it is generally appropriate to expect that each additional 1,000 m^3 of wood that is produced will result directly in approximately 0.9 long-term (permanent) jobs in the British Columbia forestry sector. This employment factor is based on Statistics Canada Census of Manufacturers data, and a study commissioned by Canadian Forestry Services in 1988. Though we believe this factor is generally conservative when compared to employment factors published in other reports, based on this employment indicator, potentially 500 direct permanent jobs will be created in British Columbia.

In terms of indirect permanent jobs generated in the Province, according to the Statistics Canada and Forestry Canada studies, it is likely that 0.98 permanent jobs will be created in non-forestry industries in British Columbia for every additional 1,000 m^3 produced. Therefore, we estimate that potentially 544 indirect permanent jobs will be created in British Columbia.

Based on the above indicators for permanent jobs and the estimated increase in MAI resulting from the Agreement, the total number of potential permanent jobs created in the Province will be in the order of 1,044. This is more than double the number estimated in the Agreement.

Jobs are likely to be generated in other provinces as well. This reflects the fact that some of British Columbia's wood production is shipped to other provinces for further processing and that many suppliers to the British Columbia forest industry are located in other provinces. Therefore, increased production in British Columbia should translate into increased employment in other provinces. The multiplier for permanent direct and indirect employment outside British Columbia, developed according to the approach described above, is 0.73 jobs for every 1,000 m^3. Therefore, a further 406 potential permanent jobs may be created in other provinces.

A summary of the estimated potential permanent employment created by the Agreement is presented in Exhibit 7, opposite.

XH 8

DIRECT SHORT-TERM EMPLOYMENT
(000'S OF DAYS)

ACTIVITY	FEDERAL DIRECT DELIVERY	PROVINCIAL DIRECT DELIVERY	COST-SHARED PROGRAMS	TOTAL
1.0 BACKLOG REFORESTATION				
1.1 SURVEYS & PRESCRIPTIONS	27.1		86.1	113.2
1.2 SEEDLINGS	3.5	28.6	163.4	195.5
1.3 SITE PREP & REHABILITATION	1.8		60.1	61.9
1.4 PLANTING	2.6		274.2	276.8
1.5 IMPLEMENTATION	5.3			5.3
1.6 EXT.,DEMO & R&D	5.8	10.7	21.6	38.1
2.0 INTENSIVE FOREST MANAGEMENT				
2.1 BRUSHING & WEEDING	2.4	1.5	58.0	61.9
2.2 CONIFER RELEASE	1.7		14.8	16.5
2.3a JUVENILE SPACING	20.9		218.3	239.2
2.3b ALLOCATION TO TFL's			26.4	26.4
2.4 FERTILIZATION	0.1		4.7	4.8
2.5 IMPLEMENTATION	3.0			3.0
2.6 EXT., DEMO & R&D	1.5	2.9		4.4
3.0 IMPLEMENTATION, COMMUNICATIONS AND EVALUATION				
3.1a IMPLEMENTATION & EVAL.	0.2	0.1	15.7	16.0
3.1b HEADQUARTERS			3.5	3.5
3.2 COMMUNICATIONS	0.2		2.8	3.0
TOTAL EMPLOYMENT GENERATED	76.1	43.8	949.6	1,069.5

ESTIMATE OF DIRECT AND INDIRECT SHORT-TERM JOBS

Short-term Jobs

Direct:	1,069,500 Employment Days 79 Days Per Job	= 13,538
Indirect:	13,538 x 1.3 (Employment Multiplier)	= 17,599
Total:		31,137

Our estimate of the short-term employment resulting from the Agreement has been developed based on Ministry of Forests records for actual silviculture projects undertaken and estimates of person-days of employment created by these projects. This data is presented in Exhibit 8, opposite. As indicated in this Exhibit, FRDA has generated an estimated 1.1 million person days of direct and indirect short-term employment in British Columbia.

By relying on previous research related to the average length of short-term employment, we estimate that the direct short-term employment created by the Agreement translates into approximately 13,538 jobs. This is based on an estimate of one short-term job representing on average 79 working days of employment. This standard is based on the findings of research studies aimed at estimating the average length of short-term jobs in the silviculture industry.

In order to assess the short-term jobs that would be created indirectly in other industries in British Columbia we adopted a multiplier of 1.3. Therefore, for every direct short-term job that is created an additional 1.3 short-term jobs will be generated indirectly. We obtained this factor from a recent research study on forest communities.

Therefore, referring back to Exhibit 8, it is evident that the Agreement can be expected to create directly and indirectly approximately 31,137 short-term jobs. This is more than twice the level targeted by the Agreement. The impact on the Provincial economy is even more significant given that studies conducted for FRDA have indicated that over 90 percent of short-term jobs go to permanent residents of the Province. At the same time, benefits also are experienced by other provinces, although in the case of short-term jobs these are likely to have been relatively low, and are extremely difficult to estimate.

Gross Domestic Product

In conducting our evaluation of the economic impacts of the Agreement, we selected gross domestic product as an overall indicator of the contribution that FRDA has made to the local, provincial and national economies. Gross domestic product (GDP) is a measure of output that takes into account the total costs of production (less costs of purchased inputs). It is, therefore, a value-added measure.

XH)

ESTIMATED POTENTIAL CONTRIBUTION TO ANNUAL PROVINCIAL GROSS DOMESTIC PRODUCT GENERATED BY FRDA ACTIVITIES

	$ Million (1986)
British Columbia	
- Direct	$33.3
- Indirect	28.4
	61.7
Other Provinces	20.0
Total	$81.7

We believe that GDP is an appropriate indicator since it can be used as the basis for estimating the total unduplicated, value-added resulting from the increased wood supply in each jurisdiction. As such, it can be used to provide an approximation of the macroeconomic impacts accruing at the local, provincial and national levels.

Based on Statistics Canada and Forestry Canada reference data, the direct and indirect value-added for each 1,000 m^3 of timber harvested in British Columbia in 1986 can be estimated at $60,000 or $60.00 /$m^3$. Therefore, based on an estimated mean annual increment of 555,600 m^3, the Agreement may directly contribute as much as $33.3 million annually to provincial GDP. Other industries in British Columbia would also benefit from the increased wood production. Based on the same data sources, a further $51.09/$m^3$ could be generated annually by other industries. This represents a contribution of $28.4 million annually.

Based on the same sources, our analysis indicated that an appropriate multiplier for estimating the contribution of the Agreement to the GDP of other provinces is $35.91/$m^3$. Therefore, a further $20.0 million could be contributed to the national economy in terms of GDP.

The total estimated potential annual increase in GDP resulting from the Agreement is estimated at $81.7 million as presented in Exhibit 9, opposite. This is not a direct "pay-back" from the Agreement, however, since it includes returns to other inputs (labour, capital investment, etc.) beyond those funded by the Agreement. In spite of this, it is clear that the Agreement has made a major contribution to the economy. These would include increased payments to local, provincial and federal governments through taxes generated by higher employment and production, and increased exports. At the same time, it is clear that some of the estimated economic gains to the economy would occur through importing of capital equipment to support increased production. There is, however, a significant lack of information on the impact that the Agreement has had on the international trading aspects of the economy. Therefore, we have been unable to prepare estimates of the likely net impact on the domestic economy.

The Silviculture Industry

It is widely accepted that the Agreement has had a dramatic effect on the forestry industry by directly and indirectly supporting a large number of silviculture and forestry firms. Our evaluation indicated that the number of silviculture contractors operating in the Province has roughly doubled under the Agreement, and is now estimated at approximately 700 firms. These firms are the main employers for many of the individuals hired to fill short-term jobs. In addition, this strengthening of the structural base of the silviculture industry could contribute to long-term efficiency gains within the forestry sector.

However, our interviews and review of previous research studies indicate that many of the silviculture firms that have emerged in recent years are highly dependent on FRDA contracts to remain in operation. As a result, it is likely that many of these firms will operate on a smaller scale or leave the business should future FRDA-type funding be terminated.

Recommendation

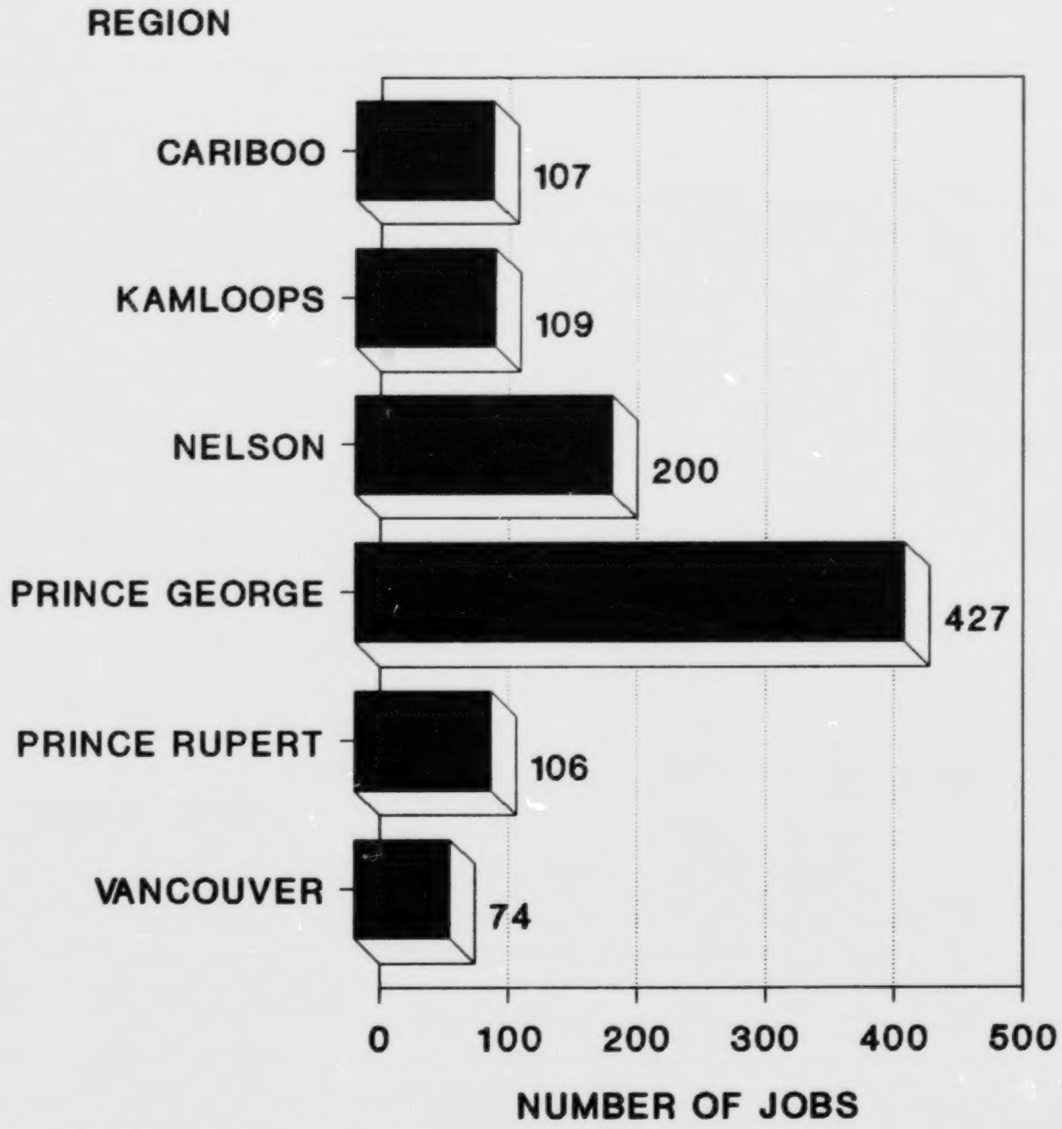
16. **A future agreement should develop employment standards and be supported by systems and processes that measure and provide sound indications of the planned and actual net economic benefits resulting from forestry investments and should be developed as an integral part of an explicit wood supply strategy for each forestry region of the Province.**

C.2. Forestry-Dependent Communities

Of particular concern in 1985 were the 126 communities throughout British Columbia that were classified as being economically forest dependent. These communities were experiencing serious economic hardship at the time the Agreement was signed. These problems were made more severe by forecasts which indicated that shortages in wood supply could be experienced in many of these communities before the end of the decade. It was believed that the backlog reforestation program would enhance the long-term viability of these communities, while short-term needs could be addressed through the intensive forest management program.

EXI 10

POTENTIAL PERMANENT EMPLOYMENT IN BRITISH COLUMBIA (DIRECT AND INDIRECT), BY REGION AS A RESULT OF FRDA ACTIVITIES



Note: Excludes Tree Farm Licences and Private and Indian Lands (approximately 21 jobs).

Given that our evaluation has been based largely on personal interviews and analyses of existing research documentation, it was not feasible to conduct an economic assessment of the conditions existing in individual communities. However, we have estimated the approximate economic impacts of the Agreement at the regional level. This has been possible since our yield projections and Ministry data have been produced at the regional level. These data, combined with previous FRDA research on economic and employment patterns at the local level, provide a reasonable indication of the general effects of the Agreement on forestry dependent communities.

Findings and Conclusions

It is evident from our evaluation that the Agreement has had a positive economic impact on forestry-dependent communities throughout British Columbia.

As illustrated in Exhibit 10 opposite, the potential permanent employment generated as a result of the activities and programs of the Agreement has been distributed across all regions, with Prince George experiencing the highest benefit. This distribution is based on the pattern of our incremental wood supply, and corresponds to average employment patterns for the British Columbia forestry industry in the mid-1980's.

Exhibit 11, overleaf, provides an estimate of the total regional distribution of direct short-term employment based on actual activity as reported for FRDA. We have assumed that direct short-term employment for the direct delivery programs, would be distributed in a manner essentially comparable to that of the cost-shared programs. The indirect short-term employment in each region is more difficult to establish and has not been included in the Exhibit. However, it is reasonable to expect that some indirect short-term employment would apply to each region resulting in total short-term employment by region, higher than shown in the Exhibit.

Surveys of workers on FRDA-funded reforestation and intensive forestry management projects have indicated that workers are drawn overwhelmingly from the labour force closest to where the work is being undertaken. In addition, throughout the term of the Agreement, the experience of workers on FRDA projects has been increasing, indicating that a more stable and experienced labour force has emerged in some communities.

ESTIMATED SHORT-TERM EMPLOYMENT (DIRECT ONLY), BY REGION, AS A RESULT OF FRDA ACTIVITIES

	(000'S OF JOBS)			
REGION	COST SHARED	FEDERAL DIRECT DELIVERY	PROVINCIAL DIRECT DELIVERY	TOTAL
Cariboo	1.6	.1		1.7
Kamloops	1.6	.3		1.9
Nelson	1.8	.1		1.9
Prince George	3.8	.1		3.9
Prince Rupert	1.3			1.3
Vancouver	1.6	.3		1.9
Headquarters	.3	.1	.5*	.9
TOTAL	12.0	1.0	.5	13.5

* - No regional distribution available

The impact of the Agreement on local communities is illustrated by our estimate of the likely distribution of potential provincial GDP resulting directly from the Agreement, as shown in Exhibit 12, overleaf. Similarly, it is likely that indirect GDP increases would have benefited the regions. Therefore, actual overall benefits to each region are likely to be higher than shown in the Exhibit. This represents a substantial annual contribution to the economies of these regions, and their respective communities.

The permanent and short-term employment and GDP impacts of the Agreement at the regional level, combined with the local employment patterns that have been determined to exist in the forestry sector, indicate that the Agreement has contributed to both the short and long-term economies of local communities.

Recommendations

17. **A future agreement should continue to place a high priority on regional economic development and, more specifically, it should support the needs of forestry-dependent communities as expressed in regional timber supply forecasts.**

18. **A future agreement should be supported by systems and processes to promote the achievement of regional economic development objectives and this should include regional investment planning that integrates planned silviculture activities and expenditures with regional timber supply simulations.**

XHII 2

ESTIMATED POTENTIAL CONTRIBUTION TO ANNUAL PROVINCIAL GROSS DOMESTIC PRODUCT (DIRECT ONLY), BY REGION, AS A RESULT OF FRDA ACTIVITIES

REGION	($ million, 1986)
Cariboo	3.4
Kamloops	3.5
Nelson	6.4
Prince George	13.6
Prince Rupert	3.4
Vancouver	2.4
Private lands, Indian Lands and TFL's	0.6
TOTAL	33.3

D. EXTENSION, DEMONSTRATION AND RESEARCH AND DEVELOPMENT

In this sub-section we present our evaluation of the Extension, Demonstration and Research and Development (referred to here as R&D) components of the Agreement. These components were planned to represent $27 million, or close to 9 percent of the total Agreement. Funds are contained in both the Backlog Reforestation and Intensive Forest Management programs of the Agreement, although almost 90 percent were assigned to Backlog Reforestation.

The $27 million R&D components of the Agreement were allocated under three delivery programs: Federal Direct Delivery - $5 million; Provincial Direct Delivery - $8 million; and, Cost-Shared Delivery - $14 million. The Federal Direct Delivery was administered directly by Forestry Canada, Pacific Forestry Centre, the Provincial Direct Delivery by the Ministry of Forests, Research Branch and the Cost-Shared Delivery also by the Ministry of Forests, Research Branch under the direction of the Extension, Demonstration and Research and Development Working Group which, in turn, reported to the FRDA Management Committee.

Through revisions to plans and budgets, in fact $29 million will be expended on the R&D components with approximately $26.7 million allocated to projects (including facility construction) and the balance related to administrative expenditures and certain publication costs.

The R&D components of the Agreement were established to meet the following two objectives:

- support forestry research by government and non-government organizations; and,
- assist the forest industry through studies related to utilization, marketing and product development, technology transfer and training.

In assessing the extent to which these objectives have been achieved, we have organized our comments into the following two categories:

- management and administration; and,
- peer review and user survey.

D.1. Management and Administration

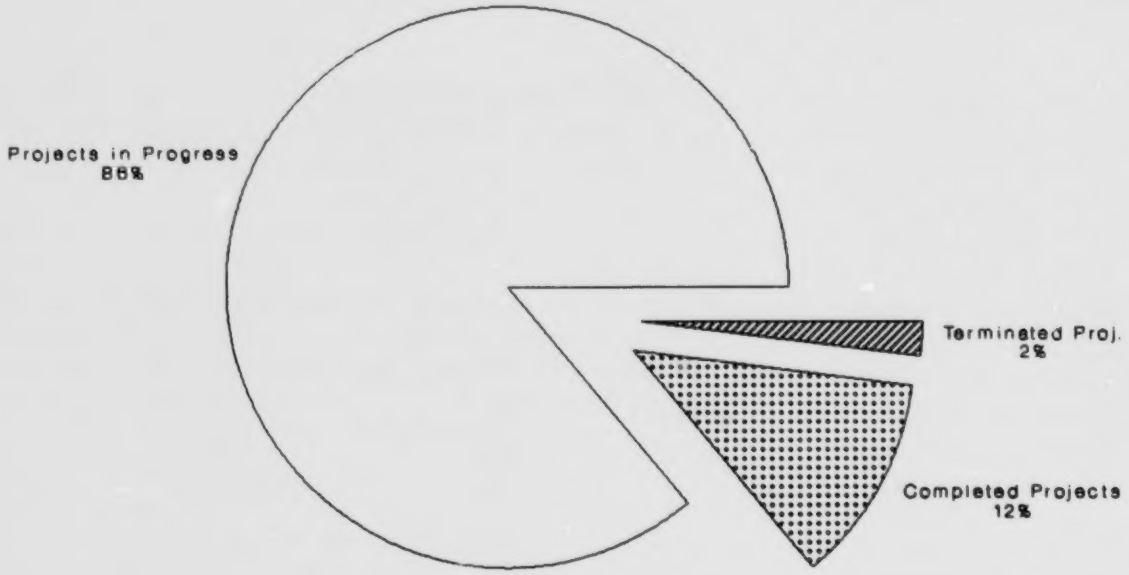
Findings and Conclusions

Our evaluation indicated that the R&D components of the Agreement have had, as intended, a positive impact on the forestry research community in the Province, particularly within government and university settings. Indeed, the ability to introduce and manage a $29 million injection in the level of forest management research funding in as short a period as five years attests to management's success in delivering this difficult component of the Agreement. Improved cooperation and communication between the federal, provincial, academic and industrial research communities has evolved. In addition, these activities have achieved some success in introducing new silviculture practices to the practising field forester at the operations level and there exists a stronger interest in and awareness of the need for on going and continuing research to improve the efficiency of forestry practices.

At the same time, we have identified some concerns with the overall management and delivery of these components. These relate to the pattern of R&D projects and expenditures under the Agreement and the operations of the Technical Advisory Committees. At the outset of the Agreement, a good understanding of the NSR backlog situation in the Province was not available. Consequently, the R&D components of FRDA appear to have lacked a coherent strategy that included a clear definition of desired end products. Given the funding uncetainty beyond five years and the emphasis placed on demonstrating early research impact, the time scale of the research was forced to focus on the term of the Agreement. Continued research under a new agreement will be needed to assess the probable stand level outcomes, in terms of biological and resultant economic impacts, of various silviculture regimes. Both of these limitations must be considered in formulating the R&D component of a future agreement.

XHI 3

STATUS OF EXTENSION, DEMONSTRATION AND RESEARCH AND DEVELOPMENT EXPENDITURES,



Note: Based on expended and budgeted project funds (approximately $26.7 million end of 1989/90).

Projects and Expenditures

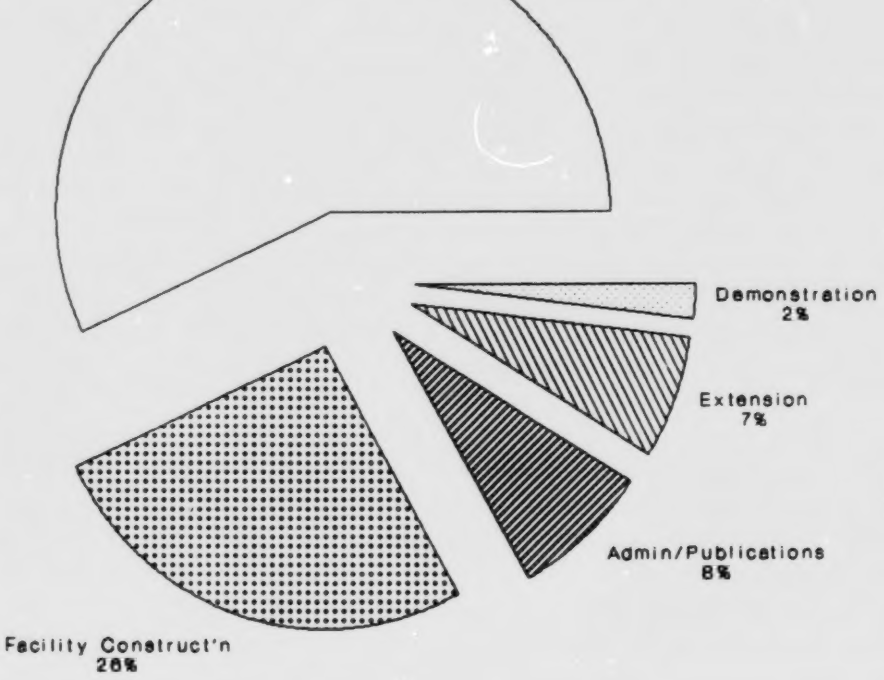
The R&D component of the Agreement experienced some initial start-up difficulties as issues of focus, intent, direction, project priorization and budgeting were considered. A sound and complete inventory of the backlog situation in terms of problems and opportunities was not available when the initial program and budget allocations were developed. As a result, a majority of projects were not initiated until well into the Agreement period and many will be completed only in the final months of the Agreement or after 1990.

The status of project expenditures (including facility construction) as of April 1989 is presented in Exhibit 13, opposite. These expenditures represent funding for approximately 312 projects. In conducting the evaluation, we reviewed the general nature of these projects, and their relationship to the Agreement objectives. At the time of our review, 86 percent of R&D expenditures were for approximately 170 projects that were still on-going. The 120 projects that had been completed represented only 12 percent of the total expenditures. It is evident from the pattern of R&D projects and expenditures that the projects that were undertaken during the early stages or that were completed during the term of the Agreement were on average smaller in size than the projects that are still on-going. Finally, approximately 2 percent of expenditures went to 22 projects that were terminated: due to the lack of availability of the researcher; the preliminary results of the studies; or, it was determined they were better dealt with in combination with another project.

Given the large number of projects still underway, a large proportion of research findings may not be communicated or incorporated into forestry practices during the Agreement's term. Our interviews indicated that operational-level staff in government and industry are experiencing difficulties assessing the research reports that already have been produced and distributed. Disseminating the research findings will heighten this concern even further as reports are distributed for the remaining 170 projects, over the next few months.

In addition, our evaluation indicates that only a small percentage of total R&D expenditures went to extension and demonstration of research information. While the Agreement has as an objective the dissemination of information, the funds directed to achieving this objective seemed low. We recognize the Agreement did not specify the allocation of dollars specifically to extension and demonstration, yet it did consider it

NATURE OF EXTENSION, DEMONSTRATION AND RESEARCH AND DEVELOPMENT EXPENDITURES



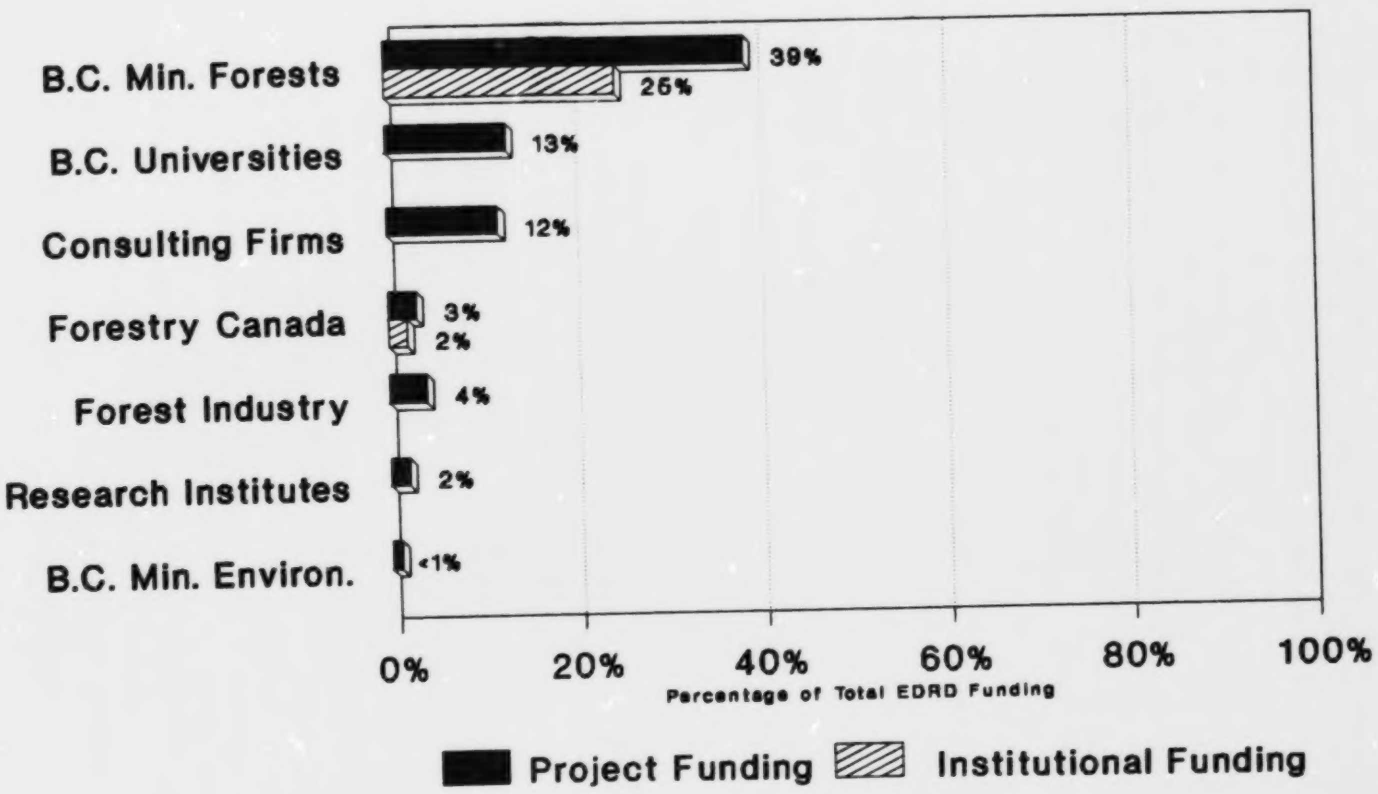
NOTE: Based on expended and budgeted project funds (approximately $29 million end of 1989/90).

sufficiently important to establish dissemination as an objective of R&D. In Exhibit 14 opposite, we present the distribution of project expenditures between extension, demonstration, research and development, facility construction and administration and publications. As indicated in the Exhibit, 57 percent of expenditures have been allocated to research and development projects, 26 percent to facility construction, 8 percent to administraion and publications and 7 and 2 percent of expenditures have been allocated to extension and demonstration, respectively. The low level of funding for extension and demonstration occurred even though the five year plan developed to guide extension, demonstration and research and development activities, identified extension as its first priority. However, it should be noted that the funds expended on demostration sites do not include R&D project sites which may have been used for their demonstration value.

As a result, the Agreement has achieved only limited success in addressing the widely-accepted need for existing forest management knowledge to be shared throughout the Province. The low level of funding for extension and demonstration means that the majority of research and development findings resulting from FRDA can only be communicated through published reports, rather than potentially more effective extension or demonstration activities (e.g. workshops, seminars, field demonstrations, pilot projects, and on the job training). In a future agreement, the extent of funding directed towards extension and demonstration activities will be an important consideration.

The distribution of both institutional and project related R&D funding received by the lead agency (that agency directly responsible for administering the funds) is reflected in Exhibit 15, overleaf. The Ministry of Forests was responsible for administering both the cost-shared and provincial direct delivery components of the R&D sub programs or roughly 84 percent of the dollars allocated. The majority of funds (64 percent) flowed directly through and were the responsibility of the British Columbia Ministry of Forests to support ongoing research into reforestation and intensive forest management (projects) and to support the construction of research facilities (institutional). Also, it is important to note that of those funds that did flow through the Ministry of Forests for project related activities more than 60 percent were contracted to and expended by external private industry for contract employees, technicians, equipment operators, scientific consultants, report writing and publication activities. Similarly, with respect to Forestry Canada approximately 88 percent of the R&D project funds received were contracted to private industry. Of the total project related R&D funds ($19 million) approximately $15 million was expended by individuals and institutions other than the Ministry of Forests and Forestry Canada.

EXTENSION, DEMONSTRATION, AND RESEARCH AND DEVELOPMENT FUNDING RECEIVED BY LEAD AGENCY



NOTE: Based on expended and budgeted funds (approximately $26 million to end of 1989/90).

Of the two institutions specifically identified in the Agreement, the Red Rock Research Station has received financial support. Support for the out-dated Saanich Research Station was not provided as the Management Committee opted to replace it by constructing a new Forest Science Building at the University of Victoria.

Research and Development funds of approximately $4.1 million will be used to partially support the construction of the facility at the University of Victoria, to be used to accommodate the Research Branch of the Ministry of Forests. In addition, R&D funds in the order of $2.1 million were used to partially support a new Forest Biotechnology Centre to be operated by the British Columbia Research Corporation. The centre conducts research into genetic engineering, tissue culture, ecophsiology, biofertilizers and biological control of pests. A further $1.3 million was expended on other research facilities including the Red Rock Research Station.

These initiatives were consistent with the Agreement's intent to provide funding to upgrade provincial R&D facilities.

Technical Advisory Committees

Our evaluation indicated that the Technical Advisory Committee (TAC) structures were generally appropriate for managing the cost-shared R&D components of the Agreement. The federal direct delivery R&D component utilized an internal committee comprised of Forestry Canada personnel whereas the provincial direct delivery R&D component used the normal review and approval process of the Ministry of Forests' Research Branch. These committees provided an effective mechanism for ensuring that, in general, research activities were directed by qualified professionals. Overall, they played a positive role in the management of R&D projects. We did, however, identify some opportunities for improving the operations of these committees.

With respect to the cost shared R&D activities, the three TAC's, as presented previously in Exhibit 2, prepared annually updated plans for the term of the Agreement which were recommeded to the Working Group for approval. However, they were not supported by strategic analysis (i.e. research needs by species) at the provincial or regional level to guide their funding priorities. As a result, funding decisions tended to be heavily influenced by the composition of each Committee, and the profile of funding requests received. Only the Southern Interior Technical Advisory Committee (SITAC) established formal criteria to support decision making.

Our review indicated that funding decisions by other TAC's were often based mainly on subjective assessments, rather than formal evaluation criteria.

The TAC's were provided with general terms of reference,but lacked common criteria for measuring project appropriateness and for decision-making purposes. Also, it is likely that the large size of the committees contributed to some problems that were experienced in managing work loads. In future, committees with fewer members and access to external expertise could be considered.

We noted that members of TAC's are eligible to receive financial assistance from the R&D funds under their supervision. Indeed, we identified some instances of TAC members receiving funding from the R&D budgets managed by their committee. This can lead to potential shortcomings in the control of R&D expenditures without formal procedural controls.

Recommendations

19. The R&D activities have made and will continue to make positive contributions to the forestry sector and should continue as an important priority of a future agreement.

20. The R&D activities of a future agreement should be supported by advisory committees with clear functions and strategic directions, formal operating policies, clear terms of reference, and documented common decision-making criteria.

21. A future agreement should be much more specific about what is expected from the research component in terms of a well developed integrated research strategy with clearly identified deliverable products and research timeframes.

22. The R&D component of a future agreement should encourage and promote research into the development of methods for reducing the costs of specific wood supply targets and for estimating the economic and financial returns of forestry investments.

D.2. Peer Review and User Survey

Findings and Conclusions

In general, it was difficult to assess the overall quality and value of the research that has been supported by the Agreement, given that a majority of the projects are not yet completed. Therefore, our evaluation has been based on a sample of the limited number of completed projects that were available at the time of the study.

From the approximately 60 published and completed projects, our Peer Review Panel selected 20 projects for detailed evaluation. The projects were selected using a sampling technique weighted by the size of the budget and the target action. This process ensured that the larger budget projects were reviewed in a balance consistent with the overall budget of the program related to that target action. In this context, the target actions considered included: improving the species match to site ecology (5.8 percent); improving soil, site and microsite nutrients (20.4 percent); establishing healthy/improved seedlings (36.1 percent); controlling pests/weeds/fire (21.0 percent); achieving optimum stocking over time (9.9 percent); and, harvesting and utilizing effectiveness (6.8 percent). The focus of this review was on an assessment of the quality of the projects with respect to:

- efficiency and effectiveness with which the project was conducted (i.e. methodology, value for money, level and quality of resources assigned to the project, and degree of overlap or duplication with existing research projects);
- applicability and potential economic impacts of the research conducted (i.e. operational potential of the findings, likely costs and benefits of the application/technique being studied, scope or magnitude of the potential finding, and time period to realize results); and,
- scientific quality of the research (qualifications of the researcher, measurement/statistical techniques, degree to which methodology would yield consistent results, and extent of innovative thinking).

Relative to the above criteria, our Panel concluded that the quality of the research projects supported by the Agreement was acceptable. Our sample of the 20 completed projects also revealed a wide-range in the quality of work performed. Some projects were judged to be of extremely high quality, while others were assessed as being of limited quality and value.

The Peer Review Panel commented favourably on the impact that FRDA funding was having on forestry research. The Agreement has contributed directly to a growing forestry research community consisting of universities, consulting firms, government and industry research organizations, and forestry firms. At the same time, it was recognized that the bulk of research activities continues to be led by government.

It was generally concluded, that much of the research undertaken lacked innovation. This was highlighted in the sample projects reviewed. Panel members felt that research projects generally neglected addressing issues related to the economic and financial returns associated with the silviculture topics being studied. This included a lack of emphasis on identifying means of minimizing the costs of forestry management and a limited orientation toward improving the value-added performance of the forestry sector.

Our survey of thirty-eight representatives from the British Columbia Ministry of Forests and from industry indicated that the potential users of research findings were generally supportive of the projects that have been undertaken. Positive progress was being made and communications were improved. However, a number of specific concerns were expressed regarding R&D projects supported by the Agreement:

- the information being produced by FRDA projects had received limited operational application, although this may change as the information becomes more fully digested by potential users;
- the Agreement has had only limited success in promoting the extension of existing or new knowledge throughout the Province;
- there has been insufficient attention paid to generating growth and yield information;

- during the final months of the Agreement, reports are being generated in a form and at a rate that are not easily absorbed by users; and,

- to date, there has been only limited instances of the results of R&D projects being used by industry to promote product development, market new products, or increase value-added in manufacturing, although this may change as projects currently under way are completed.

Recommendations

23. **The R&D component of a future agreement should support innovative research into methods of improving the performance of the forestry sector relative to product development, marketing and increased value-added manufacturing.**

24. **A future agreement should place even greater emphasis on the need to communicate research findings through extension and demonstration activities in order to facilitate the operational application of the results.**

APPENDIX A

DETAILED DISCUSSION OF FORESTRY MANAGEMENT

DETAILED DISCUSSION OF FORESTRY MANAGEMENT

In conducting our assessment of the forestry management elements and performance of the Agreement, we undertook a detailed analysis of two areas which require further discussion. These are:

- estimate of net economic value of selected forestry management projects; and,
- estimate of incremental wood supply.

Each of these two areas are discussed below.

Estimate of Net Economic Value of Selected Forestry Management Projects

As discussed in Section IV of this report, the silviculture projects that have been conducted under the Agreement have not been supported by economic value analysis. In our view, the projects supported by the Agreement are of sufficient size and potential economic risk to warrant assessment as to expected economic returns. Ideally, these assessments would be conducted prior to expenditure decisions. As a minimum, we would expect significant expenditures to be monitored and evaluated, as to expected economic returns, on a periodic basis.

Given that these evaluations are not conducted under the current Agreement, we undertook a preliminary assessment of the likely economic returns from major silviculture treatments supported by the Agreement. Our analysis is not presented as an assessment of the economic impacts of the overall Agreement. These are assessed in Appendix B. Rather, our evaluation of the estimated net economic returns of selected silviculture projects is presented as an indication of a possible approach to assessing the economy of individual silviculture investments. It is also possible to evaluate FRDA projects on a strictly net financial return basis, although this analysis was not performed as part of this evaluation.

EXHIBIT A.1 (continued)

ESTIMATED NET ECONOMIC RETURNS FROM SELECTED FRDA INVESTMENTS (CONTINUED)

ASSUMPTIONS AND NOTES

Fdc - Douglas Fir (Coast)
Fdi - Douglas Fir (Interior)
Hw - Hemlock Western
Pl - Lodge Pole Pine
Se - Englemann Spruce
Sw - Western Spruce

a.

Description of Project	Economic Return Definition	NPV/Cost Criterion*
Very Good	Excellent returns; large margins for error/problems in forecast.	50%+
Good	Robust return in addition to target ROI, useful margin.	21 to 50%
Fair	Target ROI barely met, little margin for error/problems in future.	0 to 20%
Poor	Negative return indicated, some hope for positive if conditions better than forecast.	-1 to -50%
Very Poor	Negative return indicated, little hope of redemption.	Worse than -50%

$$^{*}\frac{\text{(NPV with treatment - NPV untreated control)}}{\text{Initial Silviculture Investment Cost}} \times 100$$

b. The actual FRDA project costs shown were adjusted so that the labour content was priced at a social rate as measured by the minimum wage. The adjusted costs were then used to calculate the net economic return for the selected treatments.

NOTES:

1. A relatively high cost treatment where increased stem size in hemlock does not create much additional value.
2. Avoids significant loss of stand volume at modest cost.
3. Lower cost than situation for Note 1.
4. A high cost treatment but warranted if 25 percent of the stand could be lost to brush.
5. Diameter increases in pine are not as valuable as in other species.
6. Rated against satisfactory natural regeneration occuring. If this is not the case and a "low" volume natural stand were the alternative, site prep and planting would give a much higher economic return (i.e. "Good").
7. Shortens rotation. Good response to fertilizer in combination with thinning.
8. Cost too high relative to treatment response. A $100 lower cost improves rating to "Fair".
9. Ratings reflect both lower cost on the good site and higher cost on the medium site.

It is generally accepted that increases in expected harvest volume are not the only possible gains from silviculture investments. Changes in species, log size, and effective time of harvest can also be achieved. Though considered as part of our assessment of the likely economic returns, such gains ideally should be measured within a more comprehensive benefit-cost model than that employed here.

The expected economic benefits and costs of each FRDA investment can be assessed within a discounted cash flow framework, similar to that employed within FRDA report 014 (Nawitka 1987). Analysis of the total program in such a framework are beyond the scope of this evaluation.

Based on background work for FRDA Report 014, a limited number of silvicultural cases in each Region have been selected (the largest areas treated) for analysis. This permits at least tentative conclusions regarding the net socio-economic returns to typical program investments.

The model used for demonstration purposes in FRDA Report 014 has been used to assess broadly the main types of silvicultural action pursued under FRDA in each Region. The results are summarized in Exhibit A.1 overleaf. These should not be treated as definitive estimates, nor extrapolated as a measure of the economic return of the overall Agreement, but rather as indicative of the net economic gain at the micro level. In general, the approach is based on our view that significant silviculture expenditures can be analyzed within a species, site and location framework. The regional timber supply forecast can provide the basis for valuations of achievements over time, against the existing regional forest industry base.

The main data and assumptions used to arrive at these findings represent a wide range of data and are as follows:

- target rate of return - 4 percent real (see FRDA 014 and 071);
- cost of silvicultural activities - as encountered in FRDA program, British Columbia Ministry of Forests History Records System;
- annual maintenance cost data - as in Report 014;

EXHIBIT A.1

ESTIMATED NET ECONOMIC RETURNS FROM SELECTED FRDA INVESTMENTS

REGION & TREATMENT	SITE	ECONOMIC RETURN[a]	COST[b] ($/ha)	COMMENTS
VANCOUVER				
Plant Fdc	Medium	Good	600	
Space Hw	Medium	Poor	1000	See Note 1
Space Fdc	Medium	Good	600	
Brush Fdc	Medium	Good	375	See Note 2
PR. RUPERT COAST				
Space Hw	Medium	Fair	875	See Note 3
Brush Hw	Medium	Fair	1100	See Note 4
PR. RUPERT INTERIOR				
Site Prep. & Plant Pl	Medium	Fair	605	
Space Pl	Medium	Fair	690	See Note 5
Space & Fert Pl	Medium	Fair	880	
Brush Planted Pl	Medium	Good	265	
PRINCE GEORGE				
Site Prep & Plant Sw	Good	Poor	820	See Note 6
Site Prep & Plant Sw	Medium	Poor	750	See Note 6
Plant Sw	Medium	Poor	500	See Note 6
Space Pl	Medium	Fair	630	See Note 7
Space & Fert Pl	Medium	Good	810	See Note 7
Brush Planted Sw	Medium	Good	300	
KAMLOOPS				
Plant Pl	Medium	Very Good	465	
Space Pl	Medium	Good	450	
Space & Fert Fdi	Medium	Poor	920	See Note 8
Brush Planted Pl	Medium	Good	250	
NELSON				
Plant Se	Medium	Poor	610	See Note 9
Plant Se	Good	Good	565	See Note 9
Fert Planted Pl	Medium	Fair	168	
CARIBOO				
Plant Sw	Good	Good	510	
Space Fdi	Medium	Fair	325	
Fert Space Pl	Medium	Fair	200	
Brush Sw	Good	Fair	555	

- growth and yield data response for each treatment- modified Stephen Smith and Associates report, 1989 (Biological Responses to FRDA Treatments);
- rotation length - optimum financial/economic return (excludes non-timber values);
- merchantable volumes were priced according to log/tree size and species; prices were derived from FRDA Reports 014 and 041;
- softwood log price forecast of 1.5 percent real increase per annum over the rotation;
- logging cost forecast - constant in real terms; and,
- economic adjustments to input or output prices as necessary (see for example Duvigneau and Prasad, 1984), i.e.
    - input prices (labour costs incurred by FRDA) have been adjusted downward to reflect the actual marginal value of the use of this labour for other purposes during the project period. Unemployment was high in all regions of British Columbia at the time of program inception, but was gradually reduced by 1990; and,
    - in order to simplify the analysis, while reflecting a generally high unskilled labour availability during the period, the British Columbia minimum wage was used. While we recognize that the real rate may be different, we adopted the use of British Columbia's minimum wage to represent the real marginal value of labour.

The analysis indicates that a range of net economic returns are likely to result from the projects we studied. Of the 27 cases that were assessed, 21 can be expected to have positive returns. However, the remaining 6 projects are likely to produce minor negative net economic returns, according to our analysis. Therefore, it is possible that alternative expenditure decisions would have been made in certain cases, had an analysis of economic returns been conducted prior to project approval.

The limitations of this analysis are manifest. The stand yield projections, the regional timber supply impacts and the base cases (expected results of doing nothing) are all much weaker than could be accomplished through a full-scale program analysis.

The indicated results show the following in summary:

Very Good	1
Good	10
Fair	10
Poor	6
Very Poor	0
	27

Even though over 75 percent (Very Good, Good and Fair) of the projects analyzed showed positive net economic returns, the operational conclusion is that the economic "batting average" of any future program could be significantly improved through pre-investment analysis.

A second conclusion can be derived regarding the need for economic guidance of research and development activities. For example, where a costly silviculture activity is unlikely to yield positive economic returns due to low growth rates, the need for cost-reducing technologies to achieve the timber supply objectives can be clearly defined and pursued.

Estimate of Incremental Wood Supply

A requirement of our evaluation was to develop an estimate of the increase to Provincial long-run sustainable yield (LRSY) likely to result from the Agreement. The Agreement is not specifically supported by systems or processes to estimate the contribution to LRSY resulting from investments in silviculture activities. In preparing our estimates, we conducted detailed data analysis, based first on the Ministry of Forests approach to estimating yields, and then on our own assumptions as to the net contribution of the Agreement to LRSY.

FRDA commissioned Stephen Smith and Associates (Smith) to prepare two reports on yield.

1. Regeneration Delays and Natural Yields on Untreated Backlog Forest Land in British Columbia, 1988 (FRDA Report 043); and,
2. Biological Responses to FRDA Treatments, 1989 (unpublished FRDA Report).

These two studies were used as the basis for calculating the yields in our evaluation. Where these two studies did not cover the required species, site class or treatment regime, the project team used their best judgement in establishing the response.

The response from forest management activities is determined by using a "base case" scenario (i.e. the yield had there not been some forestry management activity). The difference between the base case and the expected yield resulting from management activity, the treated case, is the yield increment for each stand. All calculations were made at culmination of mean annual increment (CMAI) for the treated case compared to yield at the same age for the base case.

Yield calculations were made for all treated hectares by region, species, site class and treatment type. The hectares and costs were obtained from the Version 10 FRDA official numbers. Due to the time required to prepare our analyses, these data vary slightly from the more recent data on FRDA treatments, presented in Section IV of this report. The five treatments were as follows:

1. Site preparation
2. Planting
3. Brushing and weeding (including conifer release)
4. Spacing
5. Fertilization

The Version 10 numbers did not include details of species and sites treated. In order to establish species and site by treatment, data from the Ministry of Forests History Records System were obtained to provide a representative sample of species and sites by treatment within each region. The assumption was then made that the distribution of activities under FRDA was proportionately the same as indicated in the History Records System.

All treatments were aggregated under two major species for each region. As well as simplifying the analysis, the response data in the Smith studies limited the analysis to this format. Neither the History Records System nor the Smith reports had sufficient information to establish actual base or treated cases (i.e. base case or treated stand conditions in terms of stocking and distribution).

Two sets of incremental yields were calculated using two different base cases. These are described below.

Yield Increment Using Ministry of Forests Standard Procedures

The first set of estimates was calculated using the criteria that the British Columbia Ministry of Forests uses in calculating yields in their timber supply analysis. This method assumes that the contribution to long-run sustained yield (LRSY) from non-satisfactorily restocked (NSR) lands is zero until such time as it is stocked to satisfactorily restocked (SR) conditions. Therefore, the base case in this style of analysis for planting is zero.

There are only two activities that contribute to incremental yield in this scenario: planting and fertilization.

Planting

As previously mentioned, this base case for planting is zero yield, therefore the increment is 100 percent of the Smith yield for planting by region, species and site. (The project team had to use their best judgement for areas treated in the "poor" site class).

Fertilization

The yield increment for fertilization is 100 percent of the yield difference in the first Smith report using a base case of "natural, spaced" to a treated case of "natural, spaced and fertilized".

No other treatment contributes to LRSY using the Ministry of Forests procedure. In fact, the treatment of spacing tends to yield a negative LRSY response. In this analysis, however, the response to spacing has been left at zero.

The second set of yields was calculated using a series of base cases developed from the second Smith study and the appraisal team's best estimates. There is limited empirical data on managed stands in the Province of British Columbia This creates uncertainty as to actual yield increments from different species and sites resulting from different treatments and treatment regimes. Therefore, the appraisal team developed an alternative measure to closer approximate the biological yield increment of FRDA activities.

Yield Increment Based on Biological Response

Using the same treated hectares and aggregating as above, the appraisal team developed the following base and treated cases for each species, treatment, site and region.

Site Preparation

Base Case	No increment.
Treated Case	A 10 percent increment on the planting incremental yield at CMAI for the species and site. This was to account for anticipated better distribution and the possibility of establishing more stems per hectare.

Planting

Base Case	50 percent of the planted CMAI as indicated in the Smith report. This was to account for existing regeneration, not getting full occupancy or distribution on the site during planting and the regeneration delay of natural restocking.
Treated Case	100 percent of the CMAI for planting from the Smith report for the species and site. An estimate was made for planting on "poor" sites.

Brushing and Weeding (including conifer release)

Base Case	For all species except Pine, the same base cases as planting were used. For Pine, the base case was 70 percent of the CMAI for planting. This was to reflect that if the release activity did not take place, 50 percent of the yield was in jeopardy in all species but pine, and 30 percent was in jeopardy in the pine areas.
Treated Case	100 percent of the CMAI for planting from the Smith report for the species and site. An estimate was made for planting on "poor" sites.

Spacing

Base Case	Natural stand yield for species and site from the Smith report.
Treated Case	Spaced natural stand yield from the Smith report.

Fertilization

Base Case	Natural, spaced yield from the Smith report.
Treated Case	Natural, spaced and fertilized yield from the Smith report.

Detailed Yield Data Under Alternative Measures

Based on these two approaches we identified two measures of the contribution to LRSY. The first relates to the actual yield increment likely to result from FRDA activities, according to Ministry of Forests standard procedures for estimating yields. The second approach estimates the net yield increment resulting from the Agreement, according to our biological response assumptions. This latter approach has been developed to recognize that some natural growth and yield would have occurred on NSR lands over the rotation period, had no silviculture treatments been undertaken. Therefore, the estimated amount of natural regeneration that would have occurred is "netted out" of the total yield estimate that resulted by using Ministry of Forests procedures.

The results of our analysis are summarized below. Our detailed findings under both approaches are presented in Exhibits A.2 and A.3. According to our analysis, the Agreement has essentially achieved its target to "add about 600,000 m^3 annually to the long run sustainable yield". Our analysis also shows that some growth and yield would have occurred through natural regeneration.

ALTERNATIVE ESTIMATES OF ADDITIONAL ANNUAL LONG-RUN SUSTAINABLE YIELD

Yield Increment using typical British Columbia Ministry of Forests Procedures:	555,600 m^3
Net Yield Increment based on Biological Response	432,400 m^3

EXHIBIT A.2

YIELD INCREMENTS USING TYPICAL BRITISH COLUMBIA MINISTRY OF FORESTS PROCEDURES

ACTIVITY TYPE	HECTARES TREATED	WEIGHTED AVERAGE YIELD INC PER HA (m^3)[1]	TOTAL YIELD INC (m^3)[2]	WEIGHTED AVERAGE ROTATION AGE (YEARS)[1]	TOTAL COST ($)	COST PER HA ($)	INCREMENTAL MEAN ANNUAL INCREMENT (m^3)[2]
CARIBOO REGION							
SITE PREPARATION	0	0	0	0	0	0	0
PLANTING	14,492	381	5,520,583	105	4,637,440	320	53,958
BRUSHING & WEEDING	0	0	0	0	0	0	0
SPACING	0	0	0	0	0	0	0
FERTILIZATION	5,333	41	216,014	102	959,940	180	3,006
TOTAL/AVERAGE	19,825	289	5,736,597	104	5,597,380	282	56,963
KAMLOOPS REGION							
SITE PREPARATION	0	0	0	0	0	0	0
PLANTING	19,867	279	5,546,572	105	6,556,110	330	57,417
BRUSHING & WEEDING	0	0	0	0	0	0	0
SPACING	0	0	0	0	0	0	0
FERTILIZATION	2,517	25	63,830	102	377,550	150	666
TOTAL/AVERAGE	22,384	251	5,610,402	105	6,933,660	310	58,083

[1] Rounded weighted average of the six species and site combinations analysed for each activity in the region.

[2] Sum of actual increments calculated for each of the six species and site combinations analyzed for each activity in the region.

YIELD INCREMENTS USING TYPICAL BRITISH COLUMBIA MINISTRY OF FORESTS PROCEDURES
(Continued)

ACTIVITY TYPE	HECTARES TREATED	WEIGHTED AVERAGE YIELD INC PER HA (m^3)[1]	TOTAL YIELD INC (m^3)[2]	WEIGHTED AVERAGE ROTATION AGE (YEARS)[1]	TOTAL COST ($)	COST PER HA ($)	INCREMENTAL MEAN ANNUAL INCREMENT (m^3)[2]
NELSON REGION							
SITE PREPARATION	0	0	0	0	0	0	0
PLANTING	28,500	437	12,467,895	122	11,685,000	410	105,619
BRUSHING & WEEDING	0	0	0	0	0	0	0
SPACING	0	0	0	0	0	0	0
FERTILIZATION	6,591	14	91,045	120	1,120,470	170	807
TOTAL/AVERAGE	35,091	358	12,558,940	121	12,805,470	365	106,426
PRINCE GEORGE REGION							
SITE PREPARATION	0	0	0	0	0	0	0
PLANTING	54,243	415	22,509,970	105	16,272,900	300	222,955
BRUSHING & WEEDING	0	0	0	0	0	0	0
SPACING	0	0	0	0	0	0	0
FERTILIZATION	7,577	42	316,638	102	1,439,630	190	4,302
TOTAL/AVERAGE	61,820	369	22,826,608	105	17,712,530	287	227,257

[1] Rounded weighted average of the six species and site combinations analysed for each activity in the region.

[2] Sum of actual increments calculated for each of the six species and site combinations analyzed for each activity in the region.

EXHIBIT A.2 (continued)

YIELD INCREMENTS USING TYPICAL BRITISH COLUMBIA MINISTRY OF FORESTS PROCEDURES
(Continued)

PRINCE RUPERT (COAST) REGION

ACTIVITY TYPE	HECTARES TREATED	WEIGHTED AVERAGE YIELD INC PER HA (m^3)[1]	TOTAL YIELD INC (m^3)[2]	WEIGHTED AVERAGE ROTATION AGE (YEARS)[1]	TOTAL COST ($)	COST PER HA ($)	INCREMENTAL MEAN ANNUAL INCREMENT (m^3)[2]
SITE PREPARATION	0	0	0	0	0	0	0
PLANTING	24	459	11,024	93	7,200	300	137
BRUSHING & WEEDING	0	0	0	0	0	0	0
SPACING	0	0	0	0	0	0	0
FERTILIZATION	0	0	0	0	0	0	0
TOTAL/AVERAGE	24	459	11,024	93	7,200	300	137

PRINCE RUPERT (INTERIOR) REGION

ACTIVITY TYPE	HECTARES TREATED	WEIGHTED AVERAGE YIELD INC PER HA (m^3)[1]	TOTAL YIELD INC (m^3)[2]	WEIGHTED AVERAGE ROTATION AGE (YEARS)[1]	TOTAL COST ($)	COST PER HA ($)	INCREMENTAL MEAN ANNUAL INCREMENT (m^3)[2]
SITE PREPARATION	0	0	0	0	0	0	0
PLANTING	13,165	362	4,762,574	105	3,554,550	270	52,602
BRUSHING & WEEDING	0	0	0	0	0	0	0
SPACING	0	0	0	0	0	0	0
FERTILIZATION	6,502	42	274,605	102	1,040,320	160	3,774
TOTAL/AVERAGE	19,667	256	5,037,179	104	4,594,870	234	56,376

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[1] Rounded weighted average of the six species and site combinations analysed for each activity in the region.

[2] Sum of actual increments calculated for each of the six species and site combinations analyzed for each activity in the region.

EXHIBIT A.2 (continued)

YIELD INCREMENTS USING TYPICAL BRITISH COLUMBIA MINISTRY OF FORESTS PROCEDURES
(Continued)

VANCOUVER REGION

ACTIVITY TYPE	HECTARES TREATED	WEIGHTED AVERAGE YIELD INC PER HA (m^3)[1]	TOTAL YIELD INC (m^3)[2]	WEIGHTED AVERAGE ROTATION AGE (YEARS)[1]	TOTAL COST ($)	COST PER HA ($)	INCREMENTAL MEAN ANNUAL INCREMENT (m^3)[2]
SITE PREPARATION	0	0	0	0	0	0	0
PLANTING	5,788	577	3,337,584	93	2,141,560	370	38,163
BRUSHING & WEEDING	0	0	0	0	0	0	0
SPACING	0	0	0	0	0	0	0
FERTILIZATION	16,545	6	103,622	98	2,978,100	180	1,117
TOTAL/AVERAGE	22,333	154	3,441,206	97	5,119,660	229	39,280

TREE FARM LICENCES

ACTIVITY TYPE	HECTARES TREATED	WEIGHTED AVERAGE YIELD INC PER HA (m^3)[1]	TOTAL YIELD INC (m^3)[2]	WEIGHTED AVERAGE ROTATION AGE (YEARS)[1]	TOTAL COST ($)	COST PER HA ($)	INCREMENTAL MEAN ANNUAL INCREMENT (m^3)[2]
SITE PREPARATION	0	0	0	0	0	0	0
PLANTING	879	300	263,700	100	N.A.	N.A.	2,637
BRUSHING & WEEDING	0	0	0	0	0	0	0
SPACING	0	0	0	0	0	0	0
FERTILIZATION	1,017	20	20,340	100	N.A.	N.A.	203
OTHER	0	0	0	0	0	0	0
TOTAL/AVERAGE	1,896	150	284,040	100	N.A.	N.A.	2,840

N.A. - Not Available

[1] Rounded weighted average of the six species and site combinations analysed for each activity in the region.

[2] Sum of actual increments calculated for each of the six species and site combinations analyzed for each activity in the region.

EXHIBIT A.2 (continued)

YIELD INCREMENTS USING TYPICAL BRITISH COLUMBIA MINISTRY OF FORESTS PROCEDURES
(Continued)

PRIVATE AND INDIAN LANDS

ACTIVITY TYPE	HECTARES TREATED	WEIGHTED AVERAGE YIELD INC PER HA (m^3)[1]	TOTAL YIELD INC (m^3)[2]	WEIGHTED AVERAGE ROTATION AGE (YEARS)[1]	TOTAL COST ($)	COST PER HA ($)	INCREMENTAL MEAN ANNUAL INCREMENT (m^3)[2]
SITE PREPARATION	0	0	0	0	0	0	0
PLANTING	4,815	180	866,700	110	2,271,650	472	7,879
BRUSHING & WEEDING	0	0	0	0	0	0	0
SPACING	0	0	0	0	0	0	0
FERTILIZATION	1,840	20	36,800	110	430,560	234	335
TOTAL/AVERAGE	6,655	136	903,500	110	2,702,210	406	8,214
GRAND TOTAL/AVERAGE	189,695	297	56,409,496	100	55,472,980	292	555,576

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[1] Rounded weighted average of the six species and site combinations analysed for each activity in the region.

[2] Sum of actual increments calculated for each of the six species and site combinations analyzed for each activity in the region.

EXHIBIT [illegible]

NET YIELD INCREMENT BASED ON BIOLOGICAL RESPONSE

CARIBOO REGION

ACTIVITY TYPE	HECTARES TREATED	WEIGHTED AVERAGE YIELD INC PER HA (m^3)[1]	TOTAL YIELD INC (m^3)[2]	WEIGHTED AVERAGE ROTATION AGE (YEARS)[1]	TOTAL COST ($)	COST PER HA ($)	INCREMENTAL MEAN ANNUAL INCREMENT (m^3)[2]
SITE PREPARATION	12,453	20	253,540	103	2,366,070	190	2,234
PLANTING	14,492	191	2,760,799	105	4,637,440	320	26,985
BRUSHING & WEEDING	1,787	200	357,882	105	1,000,720	560	3,586
SPACING	12,445	39	479,508	107	5,102,450	410	6,286
FERTILIZATION	5,333	41	216,014	102	959,940	180	3,006
TOTAL/AVERAGE	46,510	87	4,067,743	105	14,066,620	302	42,097

KAMLOOPS REGION

ACTIVITY TYPE	HECTARES TREATED	WEIGHTED AVERAGE YIELD INC PER HA (m^3)[1]	TOTAL YIELD INC (m^3)[2]	WEIGHTED AVERAGE ROTATION AGE (YEARS)[1]	TOTAL COST ($)	COST PER HA ($)	INCREMENTAL MEAN ANNUAL INCREMENT (m^3)[2]
SITE PREPARATION	9,352	20	187,790	103	1,496,320	160	1,587
PLANTING	19,867	189	3,746,674	105	6,556,110	330	36,637
BRUSHING & WEEDING	5,300	163	864,529	105	2,279,000	430	7,990
SPACING	6,223	56	345,900	105	4,169,410	670	4,508
FERTILIZATION	2,517	25	63,830	102	377,550	150	666
TOTAL/AVERAGE	43,259	120	5,208,723	104	14,878,390	344	51,388

[1] Rounded weighted average of the six species and site combinations analysed for each activity in the region.

[2] Sum of actual increments calculated for each of the six species and site combinations analyzed for each activity in the region.

EXHIBIT A.3 (continued)

NET YIELD INCREMENT BASED ON BIOLOGICAL RESPONSE
(Continued)

NELSON REGION

ACTIVITY TYPE	HECTARES TREATED	WEIGHTED AVERAGE YIELD INC PER HA (m^3)[1]	TOTAL YIELD INC (m^3)[2]	WEIGHTED AVERAGE ROTATION AGE (YEARS)[1]	TOTAL COST ($)	COST PER HA ($)	INCREMENTAL MEAN ANNUAL INCREMENT (m^3)[2]
SITE PREPARATION	18,556	24	444,798	122	5,195,680	280	3,673
PLANTING	28,500	218	6,222,405	122	11,685,000	410	52,713
BRUSHING & WEEDING	2,234	212	473,366	122	1,161,680	520	3,894
SPACING	6,136	-17	-101,698	122	3,804,320	620	-777
FERTILIZATION	6,591	14	91,045	120	1,120,470	170	807
TOTAL/AVERAGE	62,017	115	7,129,916	121	22,967,150	370	60,310

PRINCE GEORGE REGION

ACTIVITY TYPE	HECTARES TREATED	WEIGHTED AVERAGE YIELD INC PER HA (m^3)[1]	TOTAL YIELD INC (m^3)[2]	WEIGHTED AVERAGE ROTATION AGE (YEARS)[1]	TOTAL COST ($)	COST PER HA ($)	INCREMENTAL MEAN ANNUAL INCREMENT (m^3)[2]
SITE PREPARATION	62,643	21	1,341,186	103	11,902,170	190	11,805
PLANTING	54,243	208	11,260,520	105	16,272,900	300	111,547
BRUSHING & WEEDING	10,880	182	1,974,809	105	3,699,200	340	18,358
SPACING	7,522	100	753,566	105	4,362,760	580	9,770
FERTILIZATION	7,577	42	316,638	102	1,439,630	190	4,302
TOTAL/AVERAGE	142,865	110	15,646,719	104	37,676,660	264	155,782

[1] Rounded weighted average of the six species and site combinations analysed for each activity in the region.

[2] Sum of actual increments calculated for each of the six species and site combinations analyzed for each activity in the region.

NET YIELD INCREMENT BASED ON BIOLOGICAL RESPONSE
(Continued)

ACTIVITY TYPE	HECTARES TREATED	WEIGHTED AVERAGE YIELD INC PER HA (m^3)[1]	TOTAL YIELD INC (m^3)[2]	WEIGHTED AVERAGE ROTATION AGE (YEARS)[1]	TOTAL COST ($)	COST PER HA ($)	INCREMENTAL MEAN ANNUAL INCREMENT (m^3)[2]
PRINCE RUPERT (COAST) REGION							
SITE PREPARATION	122	35	4,261	93	115,900	950	60
PLANTING	24	228	5,462	93	7,200	300	68
BRUSHING & WEEDING	310	356	110,411	93	372,000	1,200	1,198
SPACING	411	64	26,146	100	526,080	1,280	272
FERTILIZATION	0	0	0	98	0	0	0
TOTAL/AVERAGE	867	169	146,280	96	1,021,180	1,178	1,598
PRINCE RUPERT (INTERIOR) REGION							
SITE PREPARATION	14,386	21	308,150	103	2,733,340	190	2,727
PLANTING	13,165	181	2,384,381	105	3,554,550	270	26,340
BRUSHING & WEEDING	5,164	150	772,970	105	1,600,840	310	7,171
SPACING	7,905	78	616,431	105	6,640,200	840	7,598
FERTILIZATION	6,502	42	274,605	102	1,040,320	160	3,774
TOTAL/AVERAGE	47,122	92	4,356,537	104	15,569,250	330	47,610

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[1] Rounded weighted average of the six species and site combinations analysed for each activity in the region.

[2] Sum of actual increments calculated for each of the six species and site combinations analyzed for each activity in the region.

EXHIBIT A.3 (continued)

NET YIELD INCREMENT BASED ON BIOLOGICAL RESPONSE
(Continued)

VANCOUVER REGION

ACTIVITY TYPE	HECTARES TREATED	WEIGHTED AVERAGE YIELD INC PER HA (m^3)[1]	TOTAL YIELD INC (m^3)[2]	WEIGHTED AVERAGE ROTATION AGE (YEARS)[1]	TOTAL COST ($)	COST PER HA ($)	INCREMENTAL MEAN ANNUAL INCREMENT (m^3)[2]
SITE PREPARATION	2,961	21	62,354	93	695,596	235	778
PLANTING	5,788	282	1,631,384	93	2,141,560	370	18,707
BRUSHING & WEEDING	10,680	322	3,442,578	93	4,740,270	444	37,773
SPACING	14,141	35	489,421	97	11,029,980	780	5,492
FERTILIZATION	16,545	6	103,622	98	2,978,100	180	1,117
TOTAL/AVERAGE	50,115	114	5,729,359	96	21,585,506	431	63,868
TREE FARM LICENCES							
SITE PREPARATION	0	0	0	0	0	0	0
PLANTING	879	150	131,850	100	N.A.	N.A.	1,319
BRUSHING & WEEDING	171	150	25,650	100	N.A.	N.A.	257
SPACING	4,388	20	87,760	110	N.A.	N.A.	798
FERTILIZATION	1,017	20	20,340	100	N.A.	N.A.	203
TOTAL/AVERAGE	6,455	41	265,600	100	N.A.	N.A.	2,577

N.A. - Not Available

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[1] Rounded weighted average of the six species and site combinations analysed for each activity in the region.

[2] Sum of actual increments calculated for each of the six species and site combinations analyzed for each activity in the region.

EXHIBIT A.3 (continued)

NET YIELD INCREMENT BASED ON BIOLOGICAL RESPONSE
(Continued)

PRIVATE AND INDIAN LANDS

ACTIVITY TYPE	HECTARES TREATED	WEIGHTED AVERAGE YIELD INC PER HA (m³)[1]	TOTAL YIELD INC (m³)[2]	WEIGHTED AVERAGE ROTATION AGE (YEARS)[1]	TOTAL COST ($)	COST PER HA ($)	INCREMENTAL MEAN ANNUAL INCREMENT (m³)[2]
SITE PREPARATION	5,873	15	88,095	110	3,022,110	515	801
PLANTING	4,815	90	433,350	110	2,271,650	472	3,940
BRUSHING & WEEDING	3,367	90	303,030	110	2,286,050	679	2,755
SPACING	6,761	-10	-67,610	100	5,460,650	808	-676
FERTILIZATION	1,840	20	36,800	110	430,560	234	335
TOTAL/AVERAGE	22,656	35	793,665	107	13,471,020	595	7,154
GRAND TOTAL/AVERAGE	421,866	103	43,344,542	100	141,235,776	3,348	432,384

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[1] Rounded weighted average of the six species and site combinations analysed for each activity in the region.

[2] Sum of actual increments calculated for each of the six species and site combinations analyzed for each activity in the region.

APPENDIX B

DETAILED DISCUSSION OF ECONOMIC IMPACTS

EXHIBIT B.1

PERMANENT EMPLOYMENT INDICATORS

	B.C. FORESTRY INDUSTRY				OTHER B.C. INDUSTRIES	INDUSTRIES IN OTHER PROVINCES	TOTAL EMPLOYMENT IMPACT
	LOGGING INDUSTRY	WOOD INDUSTRIES	PAPER & ALLIED INDUSTRIES	TOTAL B.C. FOREST INDUSTRY			
Employment Impact of B.C. Forestry Sector in 1979[a] (Jobs/1,000 m^3)	0.31	0.67	0.27	1.26	1.37	1.02	3.65
Estimated Impact in 1986[b] (Jobs/1,000 m^3)	0.22	0.48	0.20	0.90	0.98	0.73	2.61

(a) As determined by 1988 Canadian Forestry Services Input-Output Analysis (Report E-X-39).

(b) Based on value of shipments in British Columbia Forestry Industry in 1986, as reported by Statistics Canada Census of Manufacturers. Assumes that physical inputs and outputs and their related costs are in similar proportions to 1979.

NOTE: Numbers may not add due to rounding.

DETAILED DISCUSSION OF ECONOMIC IMPACTS

An important element of this evaluation was an assessment of the economic contributions of the Agreement. In this respect, our analysis focused most heavily on two areas:

- employment; and,
- gross domestic product (GDP).

It is important to note that our estimates of the economic annual benefits resulting from the incremental wood supply (i.e. permanent employment and contribution to GDP) are based on the assumption that growth is occurring on a managed forest estate where planned future yields contribute to current production levels.

Employment

Our estimates of permanent and short-term employment generated by the Agreement were derived separately, given the different sources of available data and information and the nature of employment generated by forestry activities. In general, permanent employment is generated by increased wood production over the long-term. Short-term jobs are created by the silviculture activities (e.g. planting, weeding, spacing) supported by the Agreement. In the paragraphs below, we first discuss estimates of permanent employment, followed by a discussion of short-term employment.

Permanent Employment

Permanent (long-term) employment was determined by combining existing employment indicators with our incremental wood supply estimates (discussed in detail in Appendix A). Indicators for permanent employment were developed from the Statistics Canada Census of Manufacturers, and a study commissioned by the Canadian Forestry Service entitled Impact of Forestry Activity on the Economy of Canada and its Provinces: An Input-Output Approach, 1988. Exhibit B.1, opposite, indicates how our permanent employment indicators were derived. As shown in the Exhibit, the employment multiplier

EXHIBIT B.2

PERMANENT EMPLOYMENT ESTIMATES

SECTOR	EMPLOYMENT FACTOR (JOBS/1,000 m^3)	EMPLOYMENT GENERATED BASED ON 555,600 m^3 MAI
B.C. Forestry Industry	0.90	500
Other B.C. Industries	0.98	544
Industries in Other Provinces	0.73	406
Total Employment	2.61	1,450

effect related to increases in wood supply has diminished since the late 1970's. This is largely attributed to a decrease in the relative proportion of labour to capital and technology in the forestry industry. Our estimates of permanent employment, assume that the relative role of labour in the forestry industry will remain constant in the future. However, this may be dependent on an increased amount of secondary manufacturing in the sector, given that the primary forestry sector is likely to continue to rely on increased capital and technology in production.

Our employment indicators were applied to our estimated incremental yield, to estimate the permanent jobs created by the Agreement. Our estimates are summarized in Exhibit B.2 opposite. It is clear from this Exhibit, that the permanent employment likely to be generated by the Agreement is well in excess of the planned level of 500 jobs.

Short-Term Employment

Our estimates of short-term employment are based on FRDA indicators of employment-days generated by actual silviculture expenditures. These indicators were established by the Backlog Reforestation Intensive Forest Management Working Group (BRIFM), and were approved by the Management Committee. They have been used throughout the term of the Agreement to estimate short-term employment (person-days) created by FRDA expenditures.

The employment factors established by BRIFM are as follows:

ACTIVITY	EMPLOYMENT GENERATED
Surveys and prescriptions	0.1 day per 1 hectare
Seeds and seedlings	1 day per 1,000 seedlings
Site preparation and rehabilitation	0.5 days per 1 hectare
Planting	2 days per hectare
Implementation	1 person year per $250,000
Extension, Demonstration & R&D	1 person year per $250,000
Brushing and weeding	2 days per hectare
Conifer release	2.5 days per hectare
Juvenile spacing	4 days per hectare
Fertilization	0.1 day per hectare
Implementation and evaluation	1 person year per $250,000
Communication	1 person year per $250,000

In assessing the employment created, the Ministry of Forests appropriately revised the factors for the following activities to better reflect the employment days expected:

Extension, Demonstration & R&D	1 person day per $500
Implementation	1 person day per $350
Implementation and evaluation	1 person day per $350
Communication	1 person day per $350

As presented in Exhibit 8, Section IV, using these indicators we estimate that approximately 1.1 million person days of short-term employment were created by the Agreement.

In order to translate these person-days into an estimate of the number of short-term jobs created, we relied on previous research related to the average length of short-term employment in the forestry industry. The first study was commissioned by the Canadian Forestry Service and is titled Economic and Social Aspects of Tree Planting in British Columbia: A Survey of Workers and Contractors (Report No. BC-X-291). It determined that the average length of employment was 72 days. This factor was considered appropriate for Program I -Backlog Reforestation.

A second study was used to obtain an indicator for average length of employment related to Program II - Intensive Forest Management. This study was conducted by the Silviculture Joint Adjustment Committee (SJAC) in 1988. It indicated that the short-term jobs created in intensive forest management activities ranged in length from 13 to 19 weeks. We selected 16 weeks to be appropriate, providing an average length of employment of 96 days based on a six-day week.

Based on the above factors, we established a blended estimate for average length of short-term employment of 79 days. This reflects the relatively high level of activity supported by Program I - Backlog Reforestation.

By applying this indicator to actual person days of employment created we estimated that 13,538 direct short-term jobs were generated by the Agreement. (Exhibit 8, Section IV).

In order to estimate the indirect short-term employment resulting from the Agreement we adopted an employment multiplier contained in a 1989 study of employment in forestry-dependent communities, titled Socio-economic Characteristics of Forest-Dependent Communities and Territorial Sub-Divisions: 1981 and 1986 (White, Duke and Fong). This report indicated that 1.3 indirect jobs are generated elsewhere in the provincial economy for every direct job. Therefore, a further 17,599 indirect short-term jobs are likely to have been generated in British Columbia (Exhibit 8, Section IV). We did not attempt to estimate the short-term jobs that may have been generated outside of the Province, since this multiplier effect is generally considered to be minimal, and an appropriate indicator is not available.

Gross Domestic Product

The potential contribution of the incremental wood supply to the local, provincial and national economies can be assessed by estimating the impact of the additional wood production on gross domestic product, or the manufacturing value-added. This approach can be used to estimate the total, unduplicated, value-added resulting directly from the increased wood supply, and indirectly from increased economic activity in other sectors.

As previously noted, the forestry industry accounts for over half the value-added in manufacturing in the Province of British Columbia. In all subregions except Vancouver and Greater Victoria the proportion will be much higher. The specific value-added for each of the six regions where volume gains have been estimated will be slightly different. This will be due to such factors as species mix, differences in regional wood products industries (different types of lumber produced, different shares of lumber and plywood) and different types of pulp and paper industries. However, we applied a Province-wide GDP indicator to each region, since specific regional factors are not available.

EXHIBIT B.3

GROSS DOMESTIC PRODUCT INDICATORS

	B.C. FORESTRY INDUSTRY				INDUSTRIES OTHER B.C. INDUSTRIES	DIRECT & IN OTHER PROVINCES	INDIRECT GDP IMPACT
	LOGGING INDUSTRY	WOOD INDUSTRIES	PAPER & ALLIED INDUSTRIES	TOTAL B.C. FOREST INDUSTRY			
GDP Impact of B.C. Forestry Sector in 1979 ($/m^3) [a]	12.83	23.00	16.81	52.63	44.81	31.50	128.94
Estimated GDP Impact in 1986[b] ($/ m^3)	14.62	26.22	19.16	60.00	51.09	35.91	147.00

(a) As determined by 1988 Canadian Forestry Services Input-Output Analysis (Report E-X-39).

(b) Based on value of shipments in British Columbia forestry industry in 1986, as reported by Statistics Canada Census of Manufacturers. Assumes that physicial inputs and outputs and their related costs are in similar proportions to 1979.

NOTE: Numbers may not add due to rounding.

Since the value-added varies with product prices and inflation, selection of an appropriate base period is important. The mid-1980's (1986) are deemed to be an appropriate period for estimating the current value-added in the forestry sector of British Columbia The sector had recovered from the worst of the recession of the early 1980's but had not yet reached the peak of value-added achieved in 1987-88.

As with the indicators used to estimate permanent employment, we derived our indicators for GDP contribution from two sources:

- the 1988 Canadian Forestry Services Input-Output Analysis (Report No. E-X-39); and,
- the Statistics Canada Census of Manufacturers.

The indicators developed using this approach are presented in Exhibit B.3, opposite. The increase in the value of the GDP factors over the 1979 - 1986 period is largely attributed to price increases. (Both sets of indicators are shown in current year dollars.)

In addition to the value-added generated directly in forest products extraction and manufacture, three additional impacts on GDP occur as a result of forestry sector activities. The first are the goods and services supplied directly to the forestry sector, such as fuel and power, non-capital tools and supplies, insurance and legal services. These direct purchases by the forestry sector are shown in the national income accounts as part of total forestry sector value of production, but are netted out for the purposes of calculating value-added or contribution to GDP. Any portion of these goods and services which could not be sold to other sectors would be lost to the provincial and national economies if the forestry sector was forced to reduce output due to a lack of commercial wood inputs.

The second impact on GDP are the derived secondary impacts which occur among the suppliers of the firms and industries which provide goods and services to the forest industry. Thus a multiplier effect is created which ripples much further into the provincial and national economies. A third set of impacts, usually called induced effects, occurs when the employees of each industry or firm impacted by a forest industry change their consumption.

EXHIBIT B.4

ESTIMATES OF CONTRIBUTION TO GDP
($1986)

SECTOR	GDP FACTOR ($/m³)	GDP CONTRIBUTED BASED ON 555,600 m³ MAI
		($ Million)
B.C. Forestry Industry	$ 60.00	$33.3
Other B.C. Industries	51.09	28.4
Industries in Other Provinces	35.91	20.0
Total GDP	$147.00	$81.7

Based on these indicators, our estimates of the contribution of the incremental wood supply to the British Columbia and national economies are presented in Exhibit B.4, opposite. Therefore, in 1986 dollars, the Agreement can be expected to contribute in the order of $81.7 million annually to GDP, at the time when the additional wood grown through FRDA actions is harvested. It is, however, important to note that this GDP estimate does not represent a direct pay-back from the Agreement, since it results from inputs (labour, capital investment, etc.) originating from sources other than FRDA.